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UNCONDITIONAL RELEASE OF THE 115-D/DR GAS RECIRCULATION FACILITY SUPERSTRUCTURE

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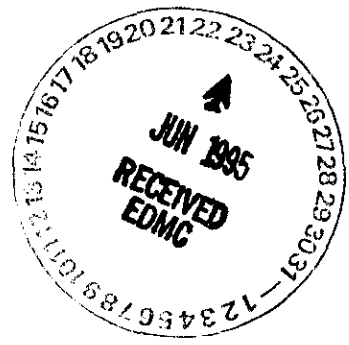

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UNCONDITIONAL RELEASE OF THE

115-D/DR GAS RECIRCULATION FACILITY SUPERSTRUCTURE

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SUMMARY

The 115-D/DR Gas Recirculation Building Decommissioning Project consists of two phases. This report is concerned with the radiological status and documentation of activities which ultimately resulted in the unrestricted release of the above-ground portion (superstructure) of the 115-D/DR Building.

Phase I activities were:
1. Asbestos Removal
2. Cell equipment removal and decontamination.

Phase II activities were:
1. Facility and tunnel demolition.
2. Site cleanup.

The 115-D/DR Building superstructure is defined as all above-ground surfaces, except the floors and the lower one-foot section of walls adjacent to the floors. The remainder of the building (floors and lower one-foot section of walls), basement tunnel, and associated gas piping tunnels will be dispositioned using the ARCL methodology and addressed in a subsequent report.

The building was constructed in 1944 to service the 105-D Reactor, and later modified to include the 105-DR Reactor. The 115-D/DR Building was shut down, along with the reactors and other ancillary buildings, by January 1971. The construction is typical of Hanford buildings that handle or process radioactive materials, in this case the cover gas from the reactors.

The radioactive contamination within the 115-D/DR facility was confined to the process cells, mainly on the floors. One exception was a small area of the Operating Gallery. Since the building was used for storing contaminated materials during its post shut-down status, the exact origin of the contamination is uncertain.

Miscellaneous radioactive material, process equipment, and associated piping were removed from the process cells and disposed of as radioactive waste. Decontamination and contamination stabilization measures were undertaken at this time, to facilitate the unrestricted release of the supersturcture, even though such activities were confined to the portion of the building not defined as part of the superstructure. These measures included covering the contaminated floors with a three-inch concrete cap and decontaminating areas along the lower one-foot section of the walls. The small area in the Operating Gallery was also decontaminated and capped with concrete. The 115-D/DR concrete superstructure was demolished under Phase II operations with a wrecking ball on June 4, 1986 and the associated rubble was transported to the 190-DR clearwell tank pit (designated as 126-DR-1).

SUMMARY (Cont'd)

Specially configured survey instrumentation was assembled and calibrated in order to ensure that the levels of detection required by the unrestricted release criteria of Groups 2 and 3 nuclides in Table 11-1, UNI-M-31, Environmental Control Manual, could be met. The final radiological survey demonstrates that Table 11-1 limits for total surface contamination and dispersed activity levels in the concrete were not exceeded.

1.0 INTRODUCTION

1.1 Purpose

The purpose of this report is to document the radiological unrestricted release of the 115-D/DR Building superstructure for demolition and burial in a non-contaminated disposal site.

1.2 Scope

This document addresses the first part of the final decommissioning of the 115-D/DR Gas Recirculation Building. Specifically it addresses the unrestricted release of the superstructure. For the purpose of this report the superstructure is defined as that portion of the above-ground structure consisting of the walls and ceiling. The walls are further defined as all verticle surfaces beginning approximately one foot above the building floor.

The in situ disposal of the floors, the remaining one foot sections of wall and the below grade structure will be documented in a separate report using the ARCL methodology.

1.3 Objective

The objective of this report is to demonstrate compliance with the criteria set forth in Table 11-1, UNI-M-31, Environmental Control Manual. The unrestricted release criteria for potentially contaminated surfaces are based on Groups 2 and 3 nuclides, in addition to the dispersed activity limits of 1 pCi/g alpha and 20 pCi/g beta-gamma.

2.0 FACILITY DESCRIPTION

2.1 Location

The 100-D Area is located within the Hanford Site on the south bank of the Columbia River, in southeastern Washington State (Figure 1). The 115-D/DR Gas Recirculation Building is located between the 105-D and 105-DR Reactor Buildings, approximately 50 meters south of the 105-D Reactor Building (Figure 2).

2.2 History

The 115-D/DR Building was constructed in 1944 for the purpose of circulating, drying, cooling, and purifying the 105-D reactor cover gas. The facility process equipment was designed to be operated remotely requiring infrequent entry into the process cells for

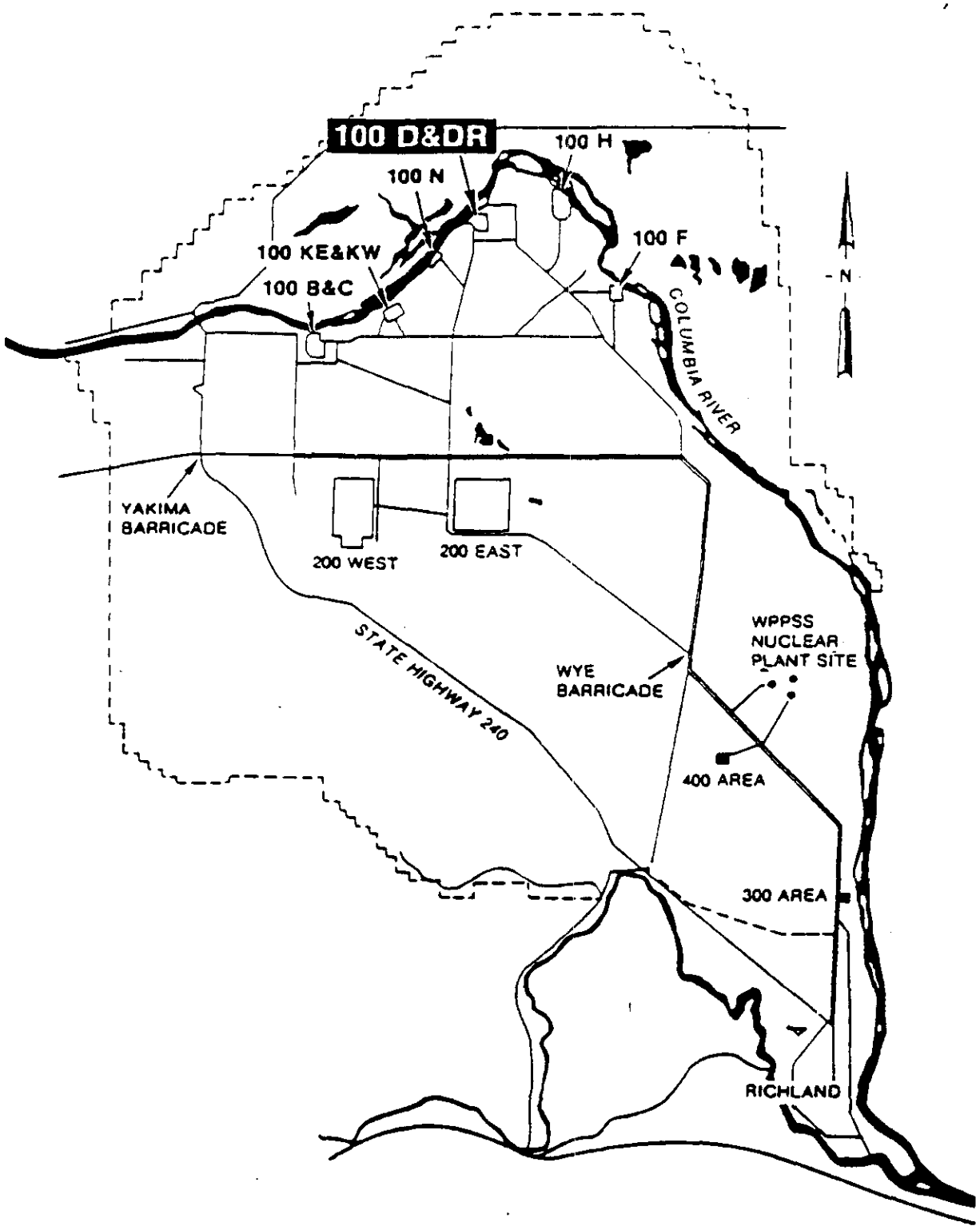

Figure 1. HANFORD SITE MAP

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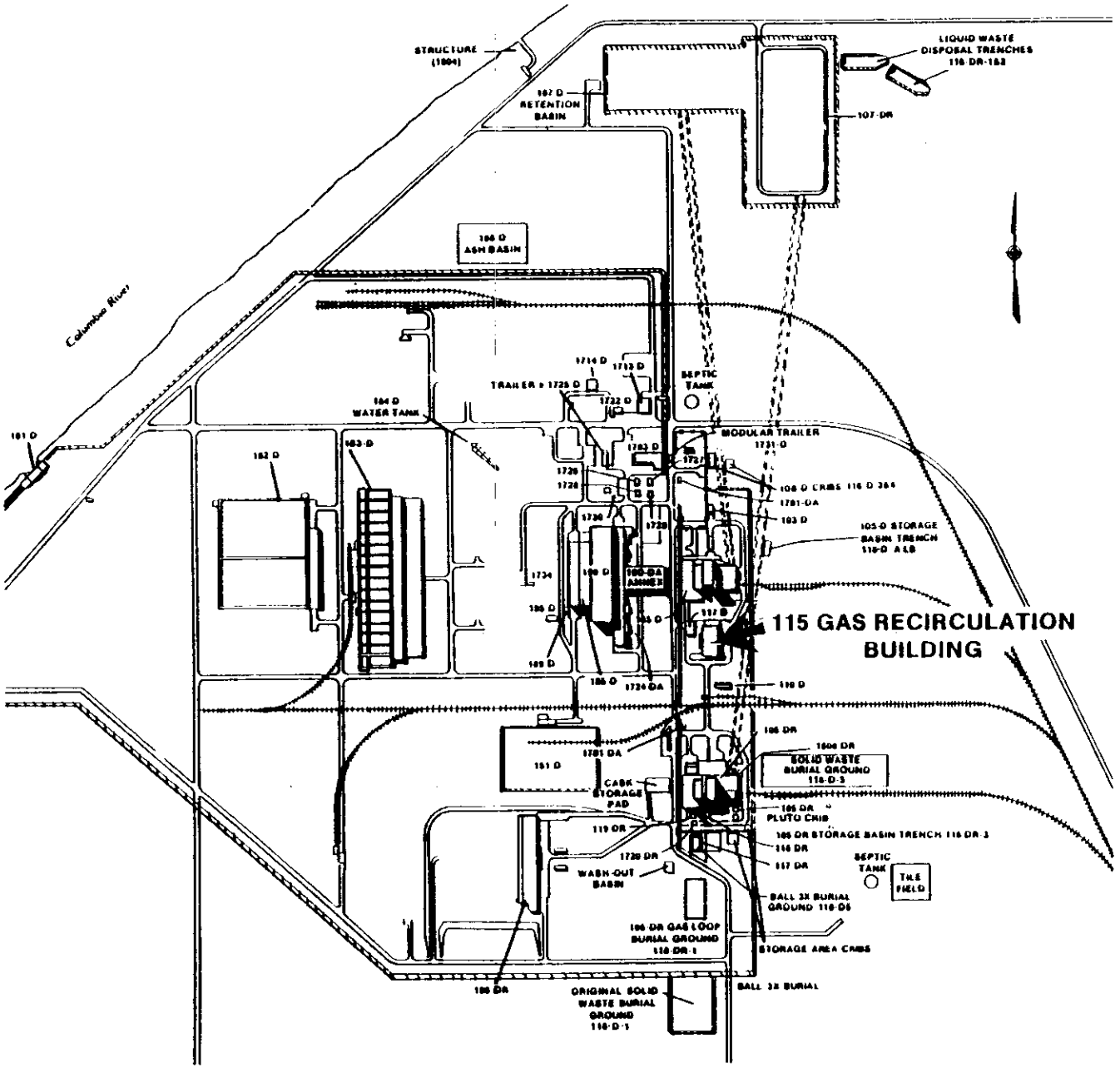

Figure 2. Location of the 115-D/DR Gas Recirculation Building in the 100-D/DR Area.

2.0 FACILITY DESCRIPTION (Cont'd)

2.2 History

maintenance. After startup of the 105-D reactor, the 115-D Building was expanded to include gas processing capabilities for the 105-DR reactor. The operation of the 100-D Area reactors and ancillary buildings was discontinued by January 1971.

During the interim between shutdown and initiation of Decommissioning and Decontamination (D&D) activities, the 115-D/DR Building was used as a storage facility for contaminated tools and equipment.

2.3 Physical Description

The 115 Buildings are composed of operating galleries, process cells, fan rooms, and support facilities. The Operating Gallery extends through the center of the building north and south and is flanked by the process cells. There is no access to the process cells from the operating gallery. Located at the south end of the operating gallery is the fan room containing the building air supply equipment, compressors, gas analyzers, office, and restroom. The process cells include the following: five dryer rooms, two cooler and blower rooms, two filter rooms, and three blower rooms (Figure 3).

The 115-D/DR building was originally designed to support the 105-D reactor. It was later modified to service both the 105-D and the 105-DR reactors. Part of the modifications consisted of the construction of Blower Room #3. Blower Room #3 was added in order to meet the expanded gas processing requirements.

Some time after the 100-D Area reactor facilities were shut down, and prior to the initiation of D&D activities, the equipment in Blower Room #3 was removed.

3.0 RADIOLOGICAL STATUS

3.1 Preliminary Surveys

Preliminary surveys with standard Hanford instruments indicated contamination within the process cells. No contamination was found in the operating gallery, fan room, or the offices at this stage of activities. The survey results with these instruments are summarized below:

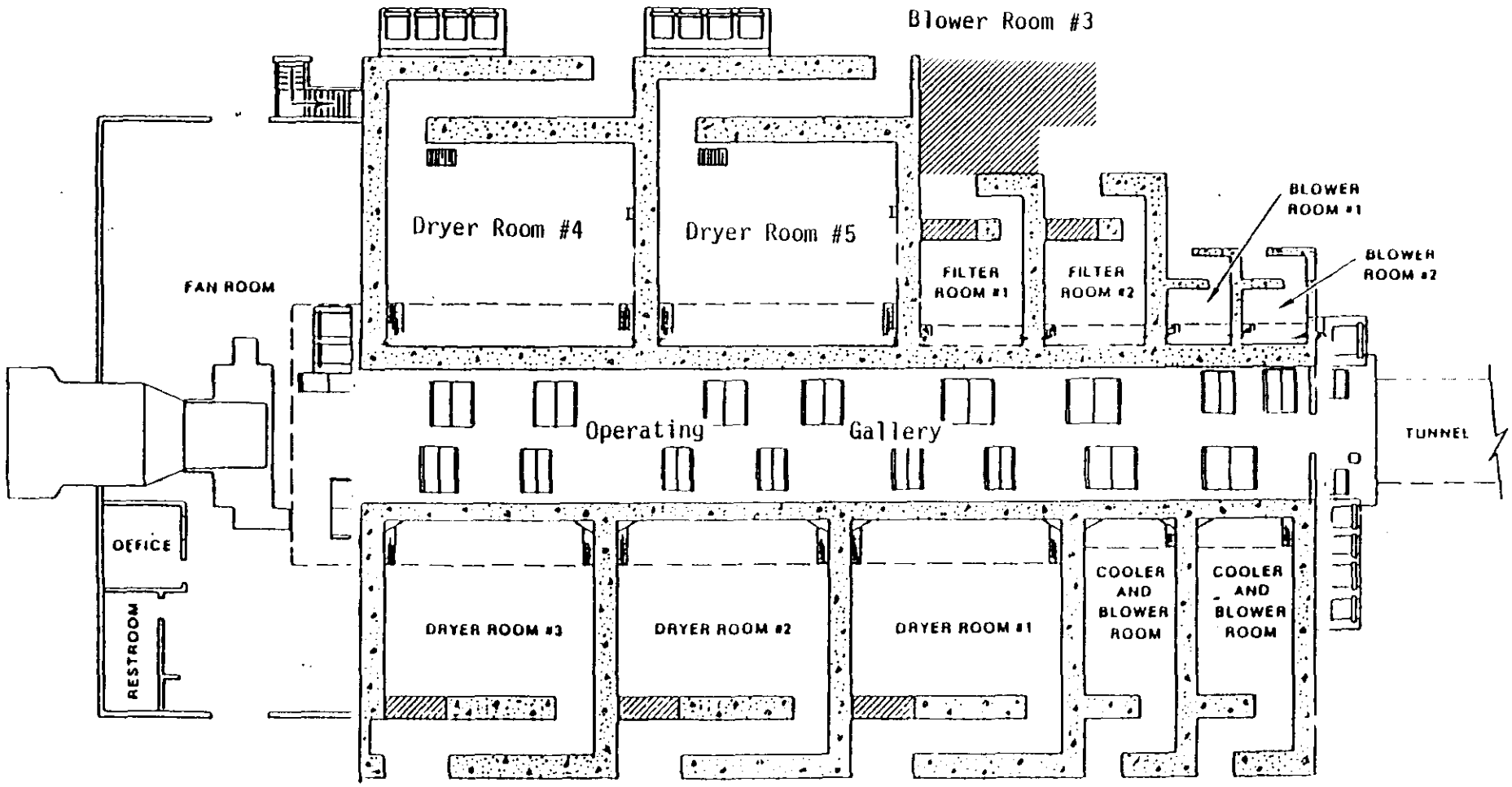

Figure 3. Plan View of 115-D/DR Gas Recirculation Building.

3.1 Preliminary Surveys (Cont'd)

Measurements of the process equipment with GM counters varied from 1,000 cpm to 15,000 cpm, with an average of 3,000 cpm. Radioactive contamination on the interior surfaces of the cells was generally confined to the floors.

Background gamma radiation levels were established outside of the facility with a Micro-R Meter and ranged from 12 to 14 micro-R/hr. Micro-R Meter readings within the facility were less than or equal to background. At no time during the survey were readings above background observed.

3.2 Equipment Removal

Several of the building process cells and the Operating Gallery were used to store miscellaneous supplies, equipment, and contaminated tools. These items were removed, surveyed, and packaged as radioactive waste and shipped to the 200 West Area for disposal.

The 115-D/DR Project Decommissioning Work Procedure (DWP) required removal of equipment from the process cells; therefore, it was necessary to open and enlarge the sealed equipment hatches (Figure 4). The equipment hatches were originally sealed with concrete block and mortar.

All contaminated equipment was removed from the process cells. The cooler blowers, filters, and other bulky equipment were unbolted or cut free of the process piping; all openings were sealed either with blank wooden flanges or quadruple layers of plastic and tape. The equipment was properly packaged and transported to the disposal facility located at the Hanford 200 West Area.

As stated previously, Blower Room 3 was a later modification to the 115-D/DR Building. It was constructed adjacent to Dryer Room #5 and Filter Room #1. In order to gain access to and remove equipment from Filter Room #1, Blower Room #3 had to be completely demolished.

The concrete debris and rubble from all the equipment hatches and Blower Room #3 were removed from the site and transported to the 184-D Area coal pit disposal area (126-D-2). Prior to demolition, the concrete block hatches were surveyed with standard Hanford portable beta-gamma and alpha instruments. The results of these surveys showed that the contamination levels were less than 200 cpm/per probe area for fixed beta-gamma contamination, less than 200 cpm/100 cm^2 for removable beta-gamma contamination, and less than 500 dpm/100 cm^2 for fixed and removable alpha. It is important to note that this survey data did not meet Table 11-1, Groups 2 and 3 unrestricted release criteria. This was due to the fact that at the time no large area survey instruments, capable of the sensitivity required to meet Table 11-1 limits, were operational for field use.

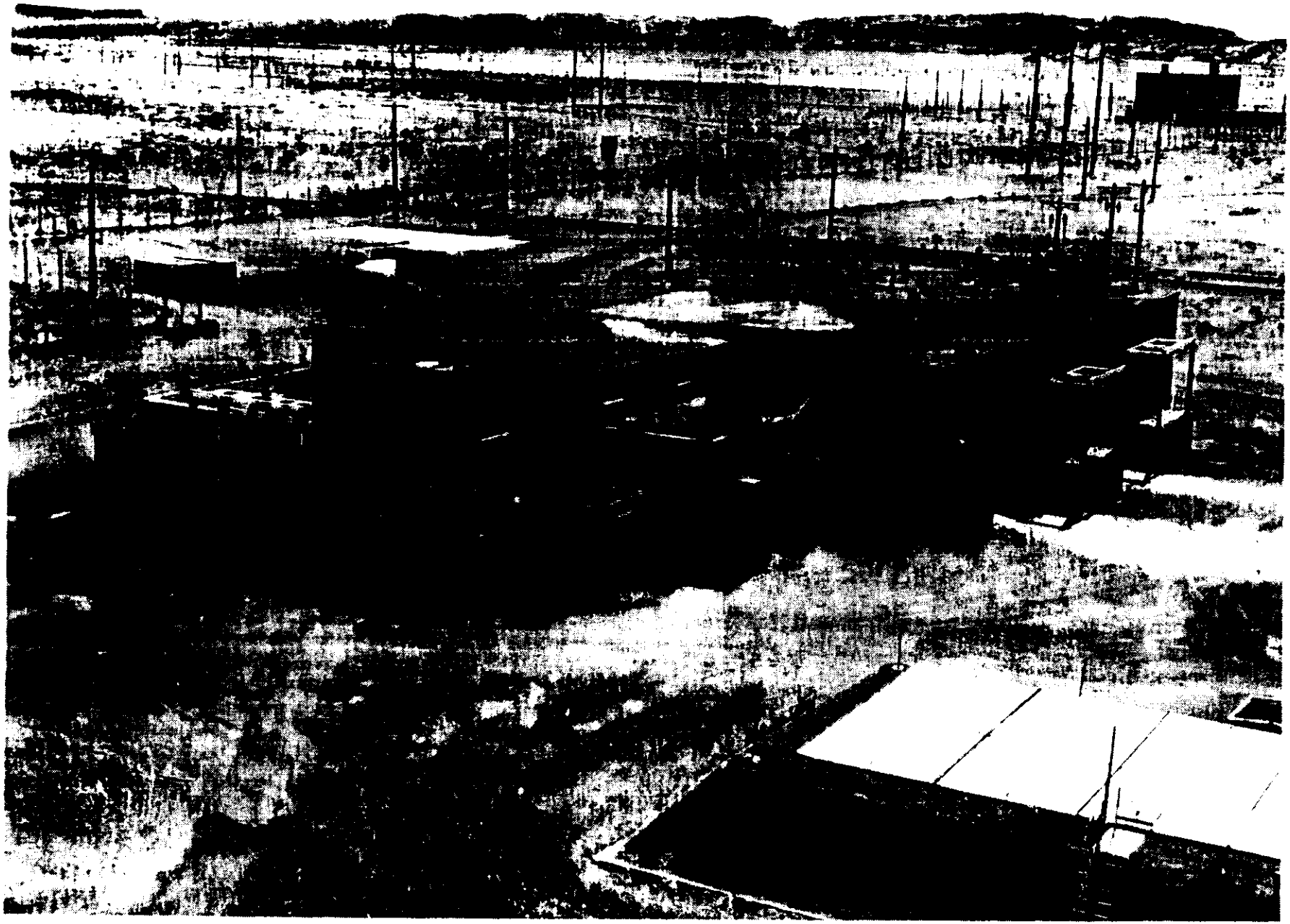

Figure 4. 115-D/DR with Openings Enlarged to Remove Equipment.

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3.0 RADIOLOGICAL STATUS (Cont'd)

3.2 Equipment Removal (Cont'd)

When large area beta-gamma and alpha gas proportional probes became operation for field use, the concrete hatch rubble and the rubble from Blower Room #3 in the 184-D Coal Pit were resurveyed. The rubble was found to be less than the limits set forth in Table 11-1 from Groups 2 and 3 nuclides. In addition, a Micro-R Meter survey of the rubble did not show any increase of gamma radiation above the natural background in the land fill site.

3.3 Stabilization of Contaminated Areas

Each of the five dryer rooms, the two cooler blower rooms, and the two filter rooms contained smearable and fixed contamination on the floor. There was also some contamination on the first one foot portion of the walls above the floor of Dryer Room #2, the labyrinth to Dryer Room #2, and Cooler Blower Room #2. In addition, a small area of contamination comprising about 8 ft^2 was discovered at the north end of the Operating Gallery. The contamination extended about 12 inches up the east wall, but was mostly confined to the floor.

In order to prevent the spread of contamination during Phase 2 demolition of the superstructure, a 3-inch concrete cap was poured over the contaminated process cell floors (Figures 5 and 6). The addition of the concrete cap provided a reduction of the background levels in the cells so that large area probe surveys could proceed. Also related to this work was the decontamination of the bottom one foot of the walls by use of the concrete scabbler to prevent possible release of contamination during demolition activities. These areas will not be further discussed in this report, but will be addressed in the final ARCL report.

3.4 Radiological Control

Prior to demolition, some decontamination work was done requiring the use of a concrete scabbler. A plastic greenhouse was built around the work area to contain any airborne activity generated by the action of the scabbler. The greenhouse was ventilated with a suction blower that filtered the greenhouse air through a HEPA filter. This system maintained a slight negative air pressure within the greenhouse and prevented the spread of contamination to the outside.

The 115-D/DR superstructure was demolished by using a wrecking ball and this portion of the project was completed on June 4, 1986. During this activity, the portions of the structure under demolition were constantly hosed down with water for dust control.

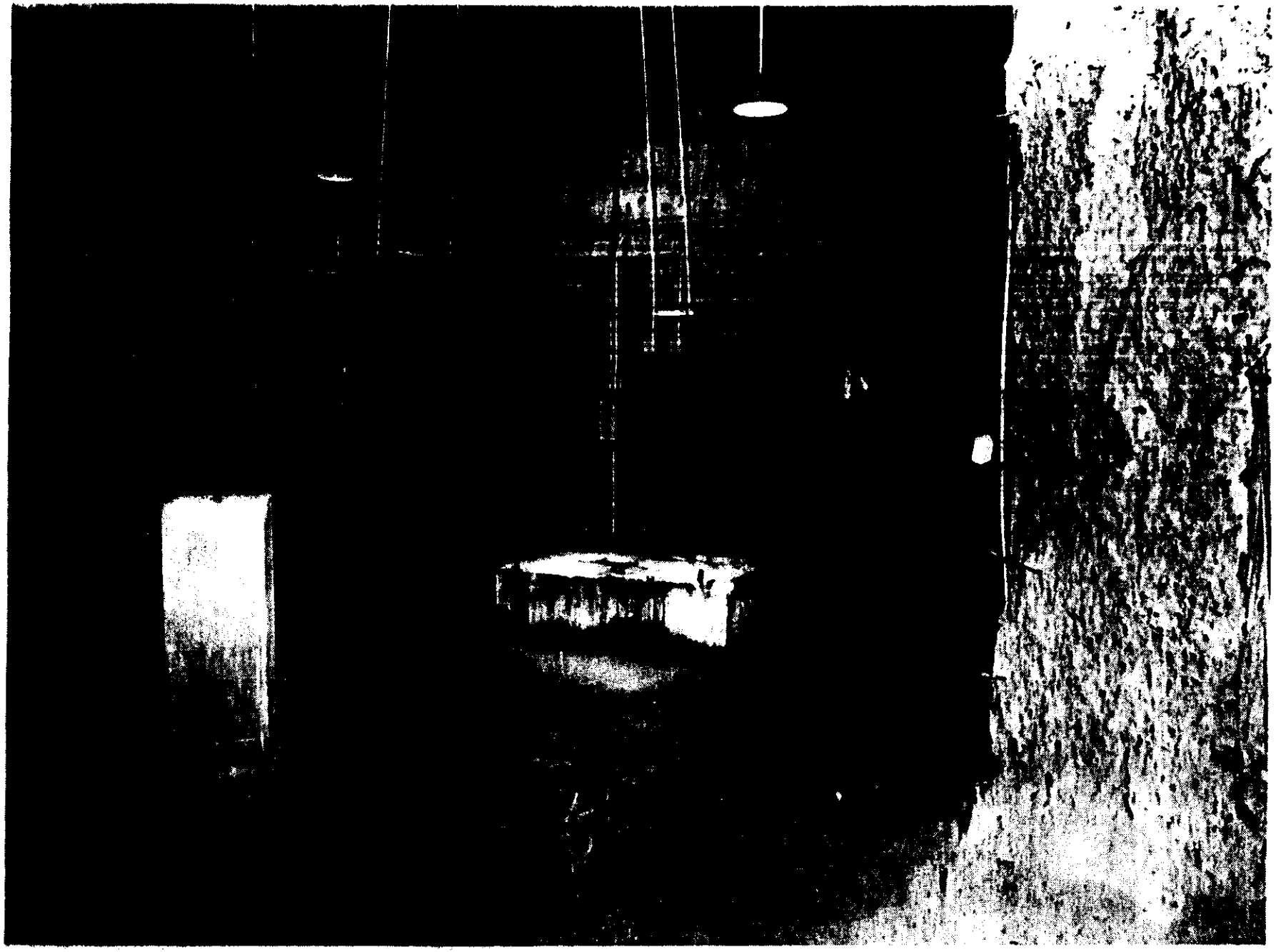

Figure 5. 115-D/DR Dryer Room #5 Before Protective Concrete Layer

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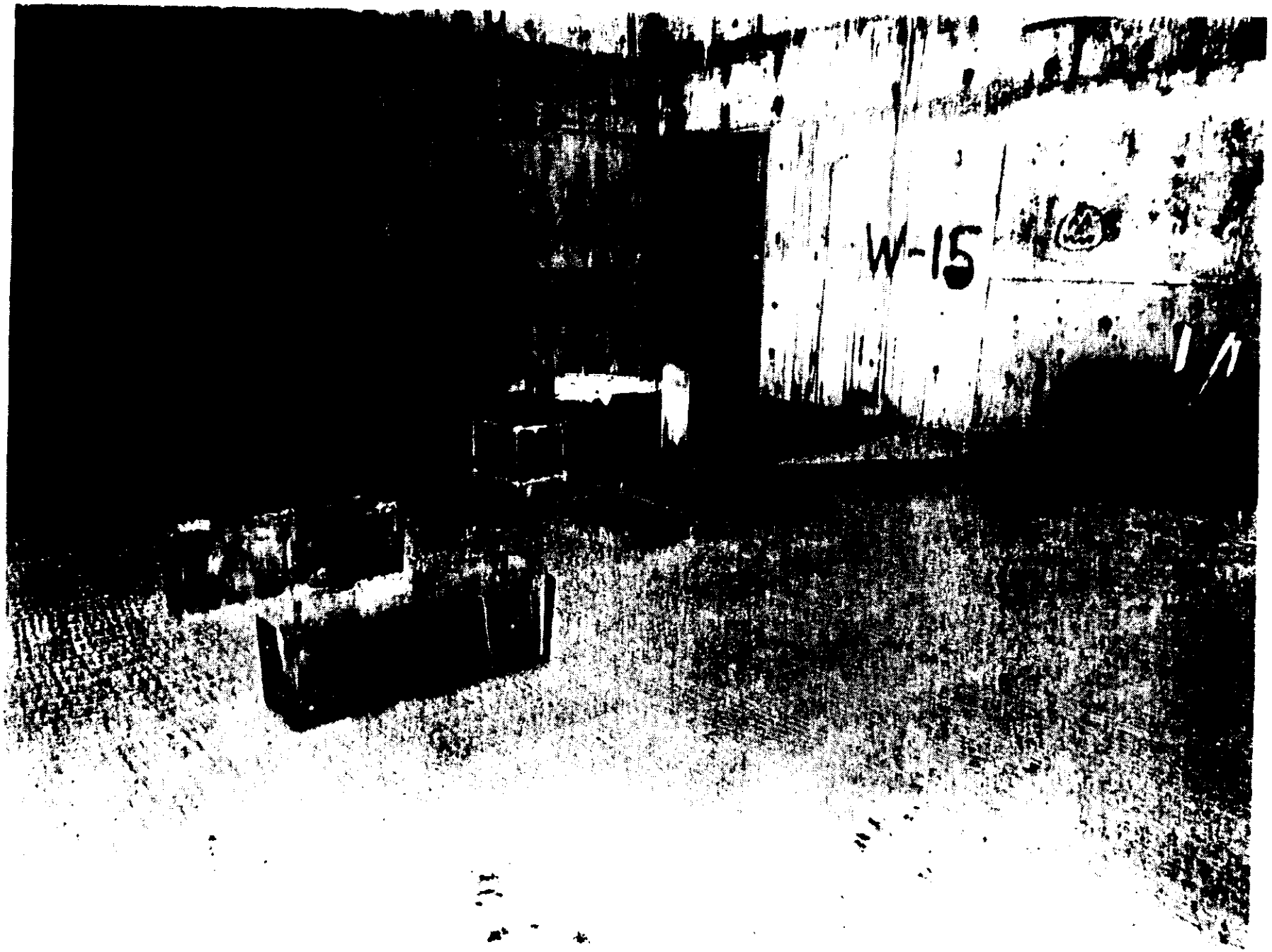

Figure 6. 115-D/DR Dryer Room #5 with Protective Concrete Layer.

3.0 RADIOLOGICAL STATUS (Cont'd)

3.5 Radiation Surveys

The first radiation survey of the building was made using the standard Hanford portable instruments: BNW-1 meter with a GM P-11 probe and portable alpha meter (PAM). Later surveys were made with the large area probes as stated below.

All surfaces of the interior of the building were divided into areas of approximately 4 m^2. Each area was defined by painted lines and an identifier within the boundaries of each area (i.e., W-3 or O-1 or F-11), where "O" indicated overhead or ceiling, "W" the walls, and "F" the floor. During the preliminary survey, a total of 301 grids were established for the superstructure.

To improve the sensitivity of the survey instruments for beta, a Ludlum Model 21 count rate meter was mated to the Ludlum gas proportional probe with a detection area of more than 100 cm^2. Also a Victoreen scintillation probe for alpha with a detection area of greater than 100 cm^2 was mated to an Eberline Mini Scaler Model MS-2.

Following the development and implementation of the Large Area Probes (LAP) the building was resurveyed grid by grid, using instruments equipped with LAP's.

Table 1 lists the results of final radiological release surveys for the 115-D/DR Building.

TABLE 1. LARGE AREA PROBE SURVEY RESULTS

Nuclide* Group	Average	Maximum
2	< 100 dpm	< 300 dpm
3	< 1000 dpm	< 3000 dpm

* See Table 11-1 in UNI-M-31 for definition of nuclide groups and their release limits.

The LAP is relatively insensitive to gamma; however, a grid by grid survey of the building was made with the Ludlum Micro-R-meter. Gamma radiation levels were less than or equal to those identified as normal background levels (Section 3.1 and Appendix B).

4.0 CHARACTERIZATION

4.1 Sampling

Originally 15 concrete samples were collected. Several samples exhibited concentrations above dispersed activity limits for alpha and beta. Additional samples were collected, of which 9 of the additional 18 were from the cells where the dispersed activity exceeded limits.

This gave a total of 33 surface concrete samples from the 115-D/DR superstructure that had been counted for gross alpha and gross beta activity (Appendix C). It was assumed that the activity levels in the superstructure's walls and ceilings were randomly distributed in one sample stratum. Based on this assumption, the mean alpha and beta activities for the 115-D/DR superstructure were calculated. Since the lowest one foot (approximate) of the walls will not be addressed in this report, but will be included in the Phase 2 demolition, no discussion of the decontaminated portion of the walls is included here.

4.2 Analyses

Table 11-1, UNI-M-31, does not specify background dispersed activity limits. As a result, the Table 11-1 dispersed activity limits were interpreted to include background with the intent being that unrestricted release criteria are met when no statistically significant concentrations above background are observed.

Background for dispersed beta and alpha activity in concrete was established by the analyses of four concrete samples from the sidewalk outside the 183-KE facility, 100-K Area. These samples were counted for total alpha and beta activity. The results of the 115-D/DR concrete samples and background concrete samples are presented in Figures 7 and 8, respectively.

The upper confidence limits (UL) of the estimated means, for the 115-D/DR and 183-KE background samples' alpha and beta activities were calculated at the 95% confidence level and are presented below. For complete sample data results and statistical calculations see Appendix C.

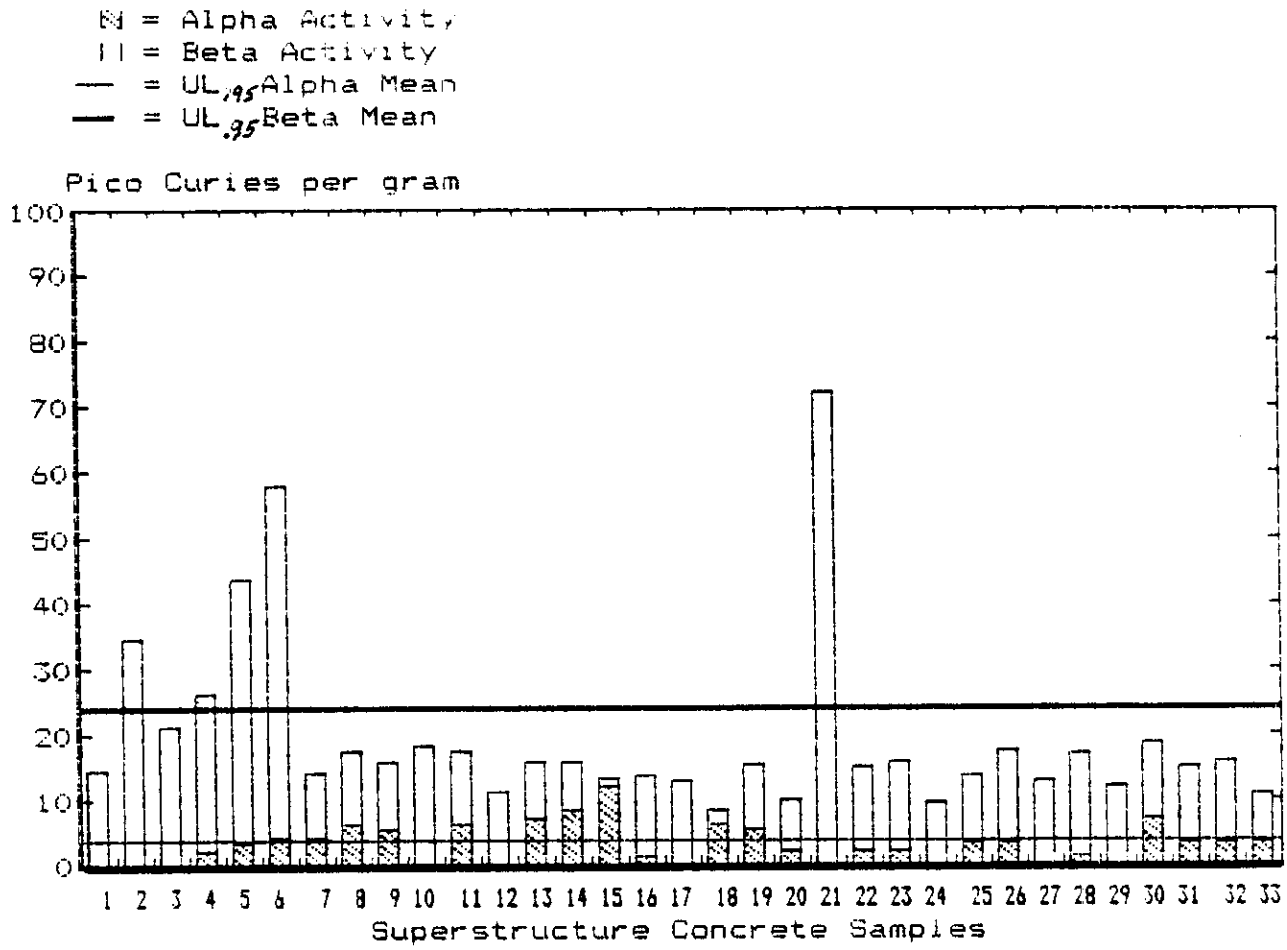

FIGURE 7. 115-D/DR DISPERSED ACTIVITY

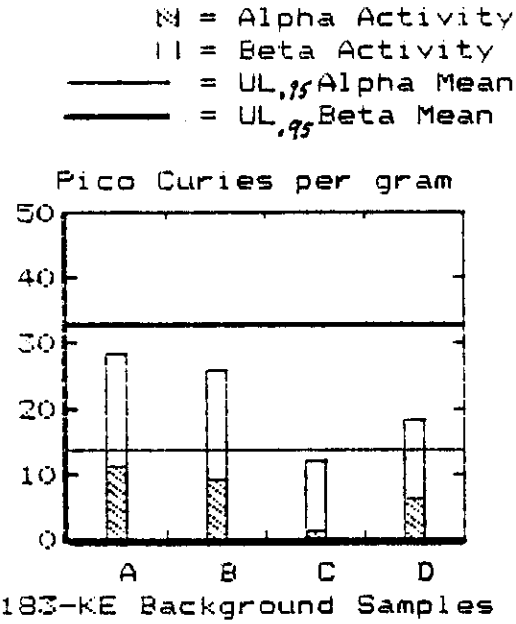

FIGURE 8. 183-KE BACKGROUND DISPERSED ACTIVITY

4.0 CHARACTERIZATION (Cont'd)

4.2 Analyses (Cont'd)

Formula for 95% Confidence Internal =

$$\bar{x} - t_{.05}\, Sx/\sqrt{n} \leq \mu \leq \bar{x} + t_{.05}\, Sx/\sqrt{n}$$

Where: $\bar{x}$ = Sample mean

μ = True mean

Sx = Standard deviation

n = Sample number

$t_{.05}$ = t value taken from the Students "t" Table with n-1 degrees of freedom. This value gives a probability of 95% that a value of t drawn at random lies between $- t_{.05}$ and $+ t_{.05}$ (Snedecor and Cochran, 1980).

$t_{.05}$ for 33 115-D/DR samples = 2.042

$t_{.05}$ for 4 183-KE bkgd samples = 3.182

TABLE 2. UPPER LIMIT FOR MEAN SAMPLE ACTIVITY

	UL Alpha Activity (pCi/g)	UL Beta Activity (pCi/g)
115-D/DR Sample Mean	4.33	24.36
183-KE bkgd Mean	13.89	33.08

A comparison of the 115-D/DR UL dispersed activity values (Figure 7) and the 183-KE background (Figure 8) clearly indicate that the alpha and beta activity of the 115-D/DR superstructure is at background levels. As a result, the intent of Table 11-1 dispersed activity limits have been satisfied since the activity of the superstructure appears to be indistinguishable from the activity levels that could be expected due to normal background.

4.0 CHARACTERIZATION (Cont'd)

4.2 Analyses (Cont'd)

Beta detection instruments usually cannot detect gamma activity with any degree of efficiency. To account for gamma activity, the Micro-R meter surveys were accepted as definitive.

5.0 RADIOLOGICAL INSTRUMENTS

Laboratory measurements for gross alpha/beta activities in concrete were made with a Canberra Model 2404 Gas Proportional Counter. The sample analysis, instrument calibration, and quality control were conducted in accordance with Decommissioning Laboratory Procedures.

5.1 Beta Instruments

Beta contamination surveys were performed using a Ludlum Model 12 count rate meter in conjunction with a Ludlum 10 x 20 cm large-area gas proportional probe. Correction factors and Minimum Detectable Activity (MDA) values were calculated as follows: A 2-inch diameter, 14,100-dpm electroplated Tc-99 disk standard was used for all calibrations.

Active Area of Probe = $4(4.7 \times 8.7)\ cm^2 = 164\ cm^2$
(4 windows)

$$\text{Efficiency of Probe's Active Area} = \frac{3425\ cpm}{14{,}100\ dpm} = 0.243 \times 100 = 24\%$$

Where: 3425 cpm = Count rate observed for the Tc-99 disk standard.

$$\text{Correction Factor} = \frac{100\ cm^2}{(0.243)\ (164\ cm^2)} = 2.5$$

NOTE: Meter indication times 2.5 gives contamination levels in dpm/100 cm^2.

MDA = (50) (2.5) = 125 dpm/100 cm^2
Where: 50 cpm = average deviation in meter readings at an average background level of 300 cpm.

5.0 RADIOLOGICAL INSTRUMENTS (Cont'd)

5.2 Alpha Instruments

Alpha contamination surveys were performed using an Eberline Model PS-2 Mini Scaler in conjunction with a Victoreen Model 702 12.8-cm diameter alpha scintillation probe. Correction factors and MDA values were calculated as follows: A 2-inch diameter, 16,700-dpm electroplated Th-230 disk standard was used for all calibration.

Diameter of probe = 12.8 cm

$$\text{Active area of probe} = \frac{(3.14)\ (12.8\text{cm})^2}{4} = 129\ \text{cm}^2$$

$$\text{Efficiency of probe's active area} = \frac{3288\ \text{cpm}}{16700\ \text{dpm}} = 0.1969 \times 100 = 19.7\%$$

Where: 3288 cpm = Average of a 10 minute count of the Th-230 disk standard.

$$\text{Correction Factor} = \frac{100\ \text{cm}^2}{(0.1969)\ (129\ \text{cm}^2)} = 3.94$$

NOTE: Display value for a one minute count times 3.94 gives contamination levels in dpm/100 cm^2

10 min. background = 1 cpm (Standard deviation of a 1 cpm background rate) where 1.96 is the 95% confidence interval.

$$\text{MDA} = 1.96 \times \sqrt{1\ \text{cpm}}\ (3.94) = 8\ \text{dpm}/100\ \text{cm}^2$$

6.0 UNRESTRICTED RELEASE RADIOLOGICAL SUMMARY

The two methods used to demonstrate compliance with Table 11-1 of UNI-M-31, Environmental Control Manual were:

1. Direct and removable surveys of the 115-D/DR Building superstructure with portable large area probes and gamma radiation levels measured at each grid.

2. Dispersed activity analysis of the concrete structure.

Unrestricted release criteria for direct and removable contamination were based on Groups 2 and 3, Table 11-1, UNI-M-31, Environmental Control Manual. The Groups 2 and 3 limits were identified as applicable since it was assumed contamination was potentially present throughout the building. Additionally, though not required at the time, a later revision of UNI-M-31 required that the surface contamination survey results should meet the sum of the fractions rule for Groups 2 and 3 Radionuclides. This additional requirement was also met.

6.0 UNRESTRICTED RELEASE RADIOLOGICAL SUMMARY (Cont'd)

Three positive indications of contamination on the walls were found in Dryer Room #2, but the maximum of 500 dpm/100 cm^2 was at one-half the limit for beta. Of the fifteen positive indications found in the Operating Gallery, fourteen were at the lower limit of detection and the one maximum of 250 dpm/100 cm^2 was one fourth of the average beta limit. All alpha surveys found no alpha contamination that was detectable. (The limit of detection is 8 dpm/100 cm^2.) Gamma radiation levels inside of the building were well below the normal background levels outside of the building (Appendix B data).

Unrestricted release limits for dispersed beta-gamma activity of the concrete samples were based on the criteria in UNI-M-31, Chapter 11.0. The 115-D/DR samples analyzed for dispersed activity did not show activity greater than the clean concrete samples that were used to establish background levels (Section 4.0 and Appendix C).

Based on the radiological survey data provided in this report and the analyses of the concrete samples for dispersed activity, the 115-D/DR building superstructure was released without restriction.

7.0 REFERENCES

1. E. M. Greager, Environmental Control Manual, UNI-M-31, UNC Nuclear Industries, Richland, WA, 1979.

2. "Unrestricted Release of the 115-D/DR Building," letter, J. J. Dorian to M. A. Mihalic, April 23, 1986.

3. Snedecor, G. W. and W. G. Cochran, Statistical Methods, Seventh Edition, Iowa State University Press, Ames, Iowa, 1980.

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APPENDIX A

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APPENDIX A

Appendix A contains photographs of the exterior of the 115-D/DR Building that show the individual process cell openings that were enlarged to allow removal of process equipment from the cells.

In addition, drawings are included of the four areas where decontamination of the walls was performed to facilitate the unconditional release of the superstructure.

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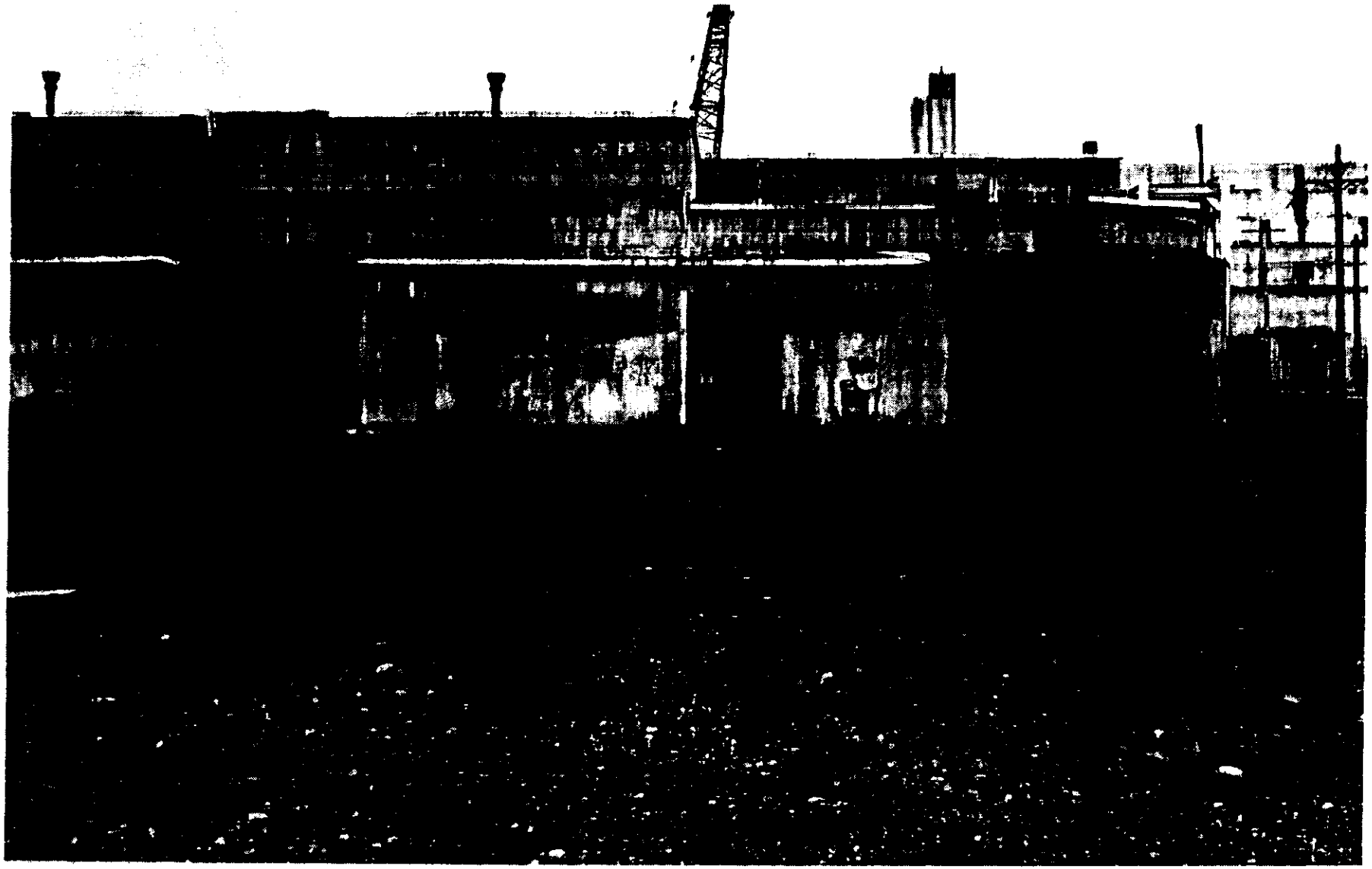
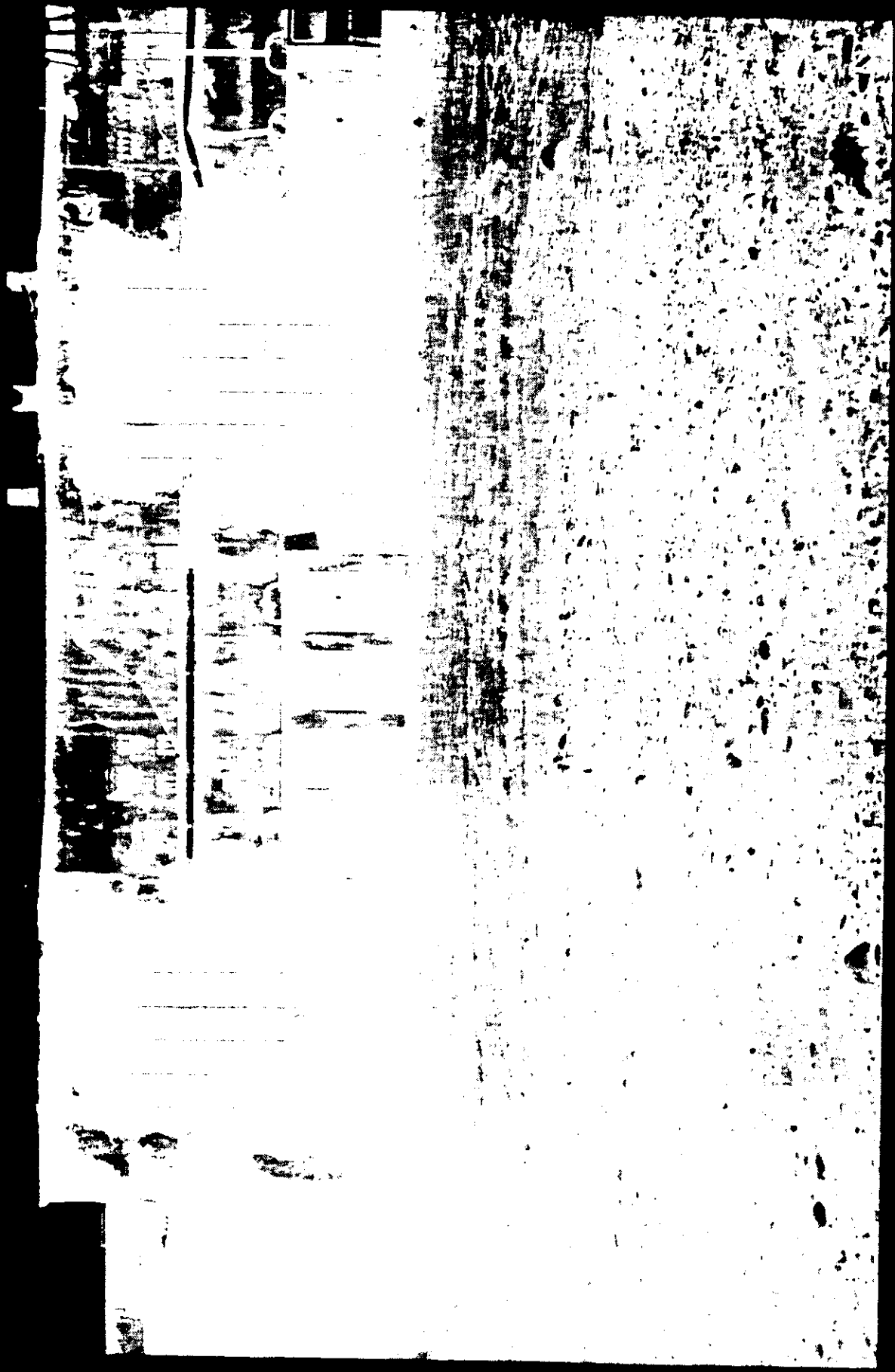
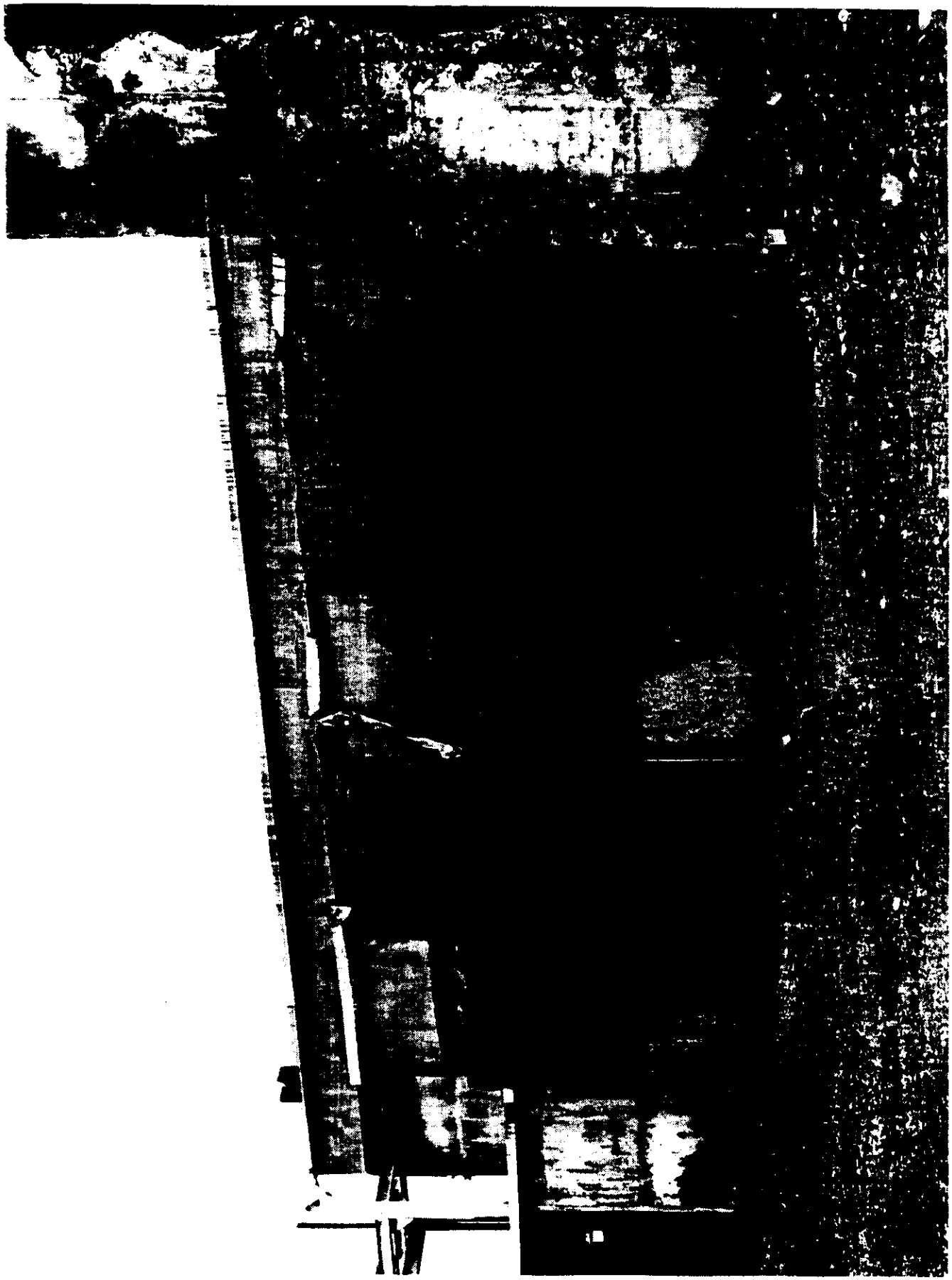


115 D/DR Entrance to Drier Room no.1, Cooler Blower Rooms no.1 & no.2

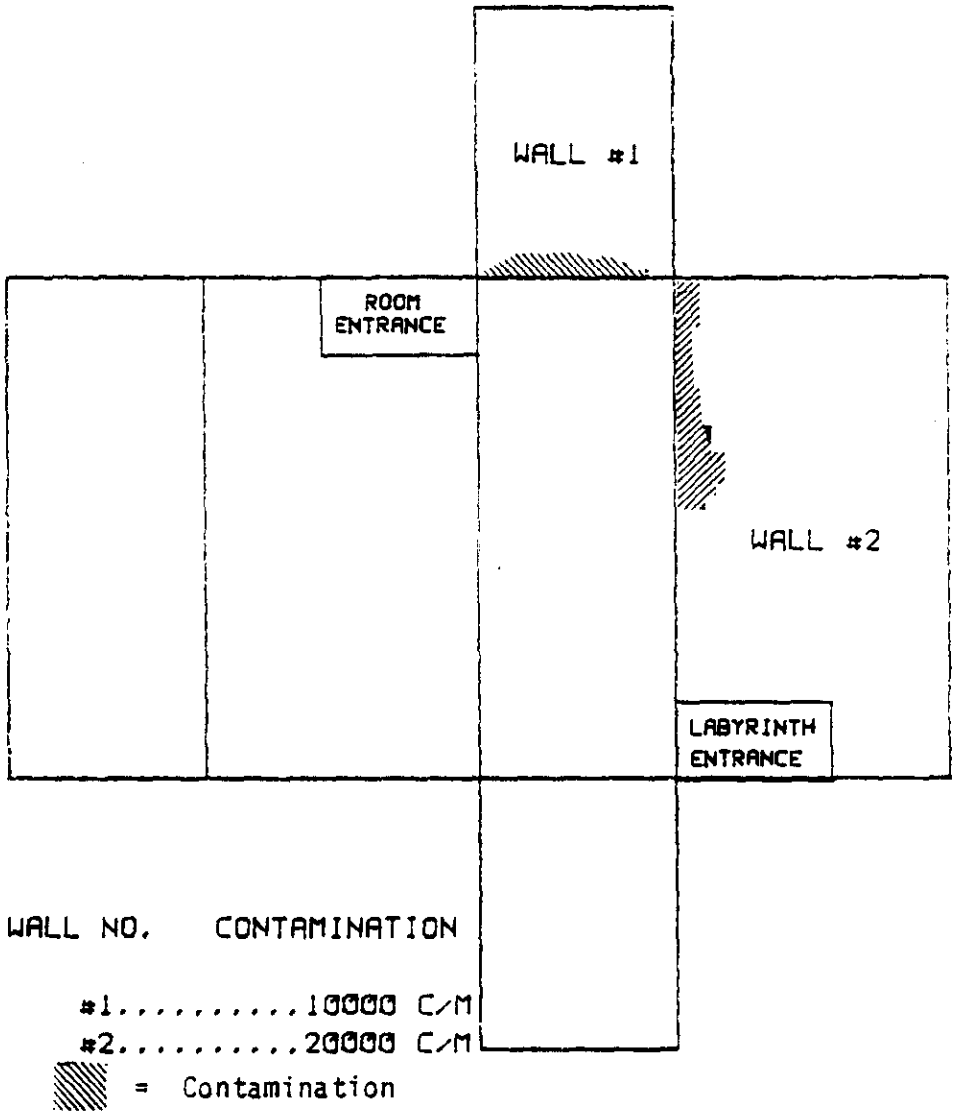


115 D/DR Entrance to Drier Rooms no.4 & no.5



115 D/DR Entrance to Filter Rooms no.2 & no.1

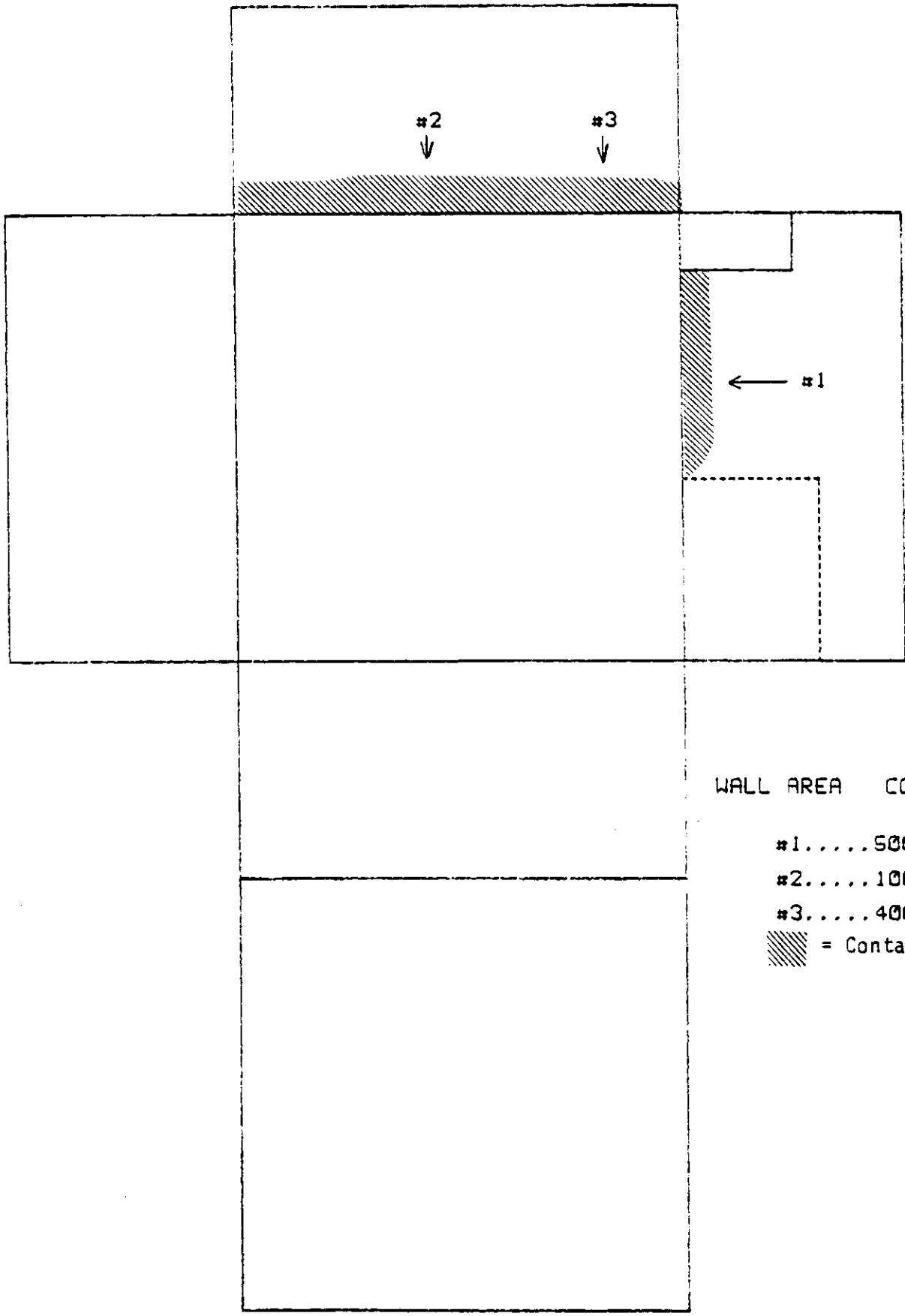
115 D/DR DRIER ROOM #2 LABYRINTH



(NOT TO SCALE)

115 D/DR DRIER ROOM #2

UNI-3807



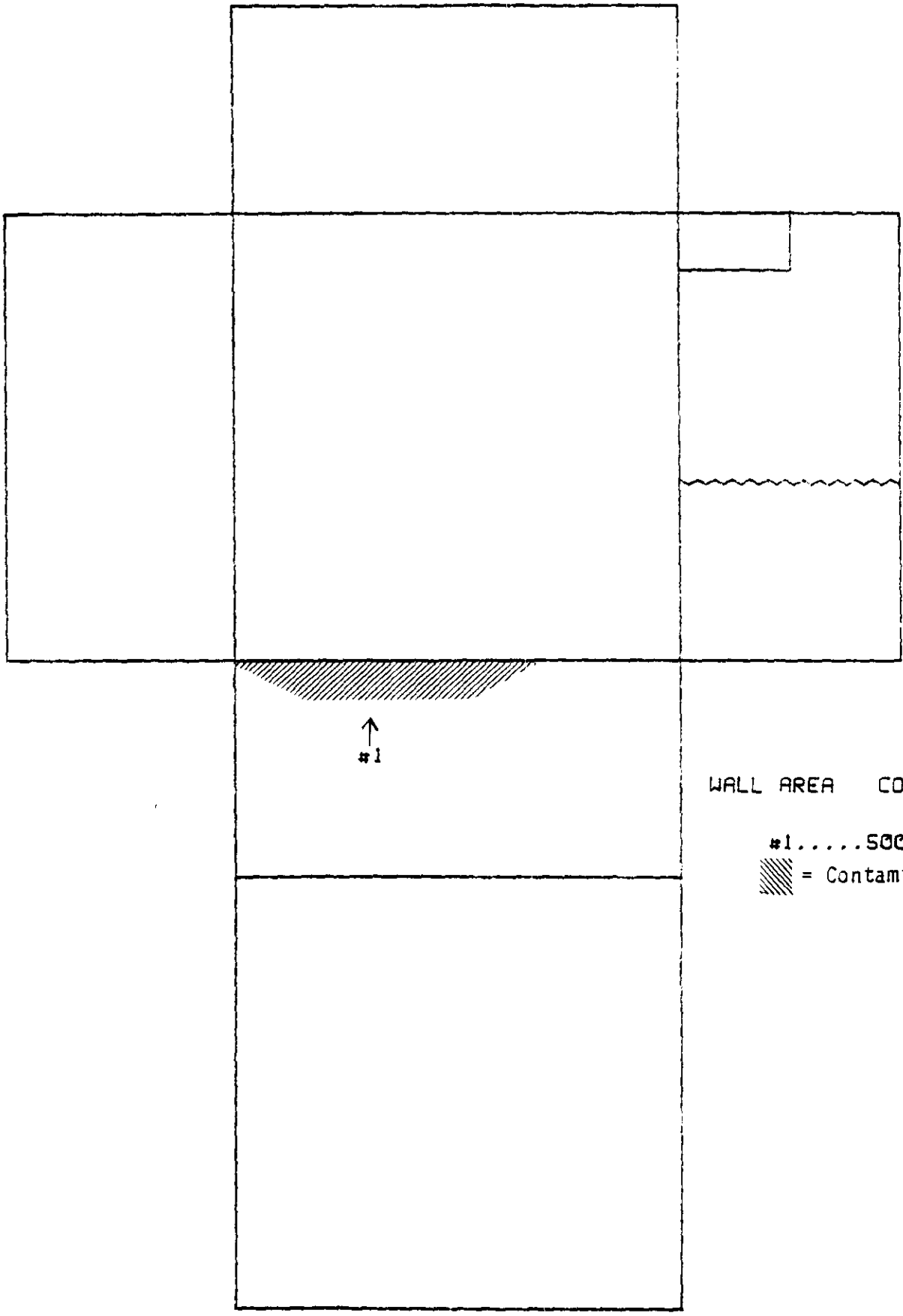
WALL AREA CONTAM.

#1.....5000 C/M
#2.....1000 C/M
#3.....40000 C/M
= Contamination

(NOT TO SCALE).

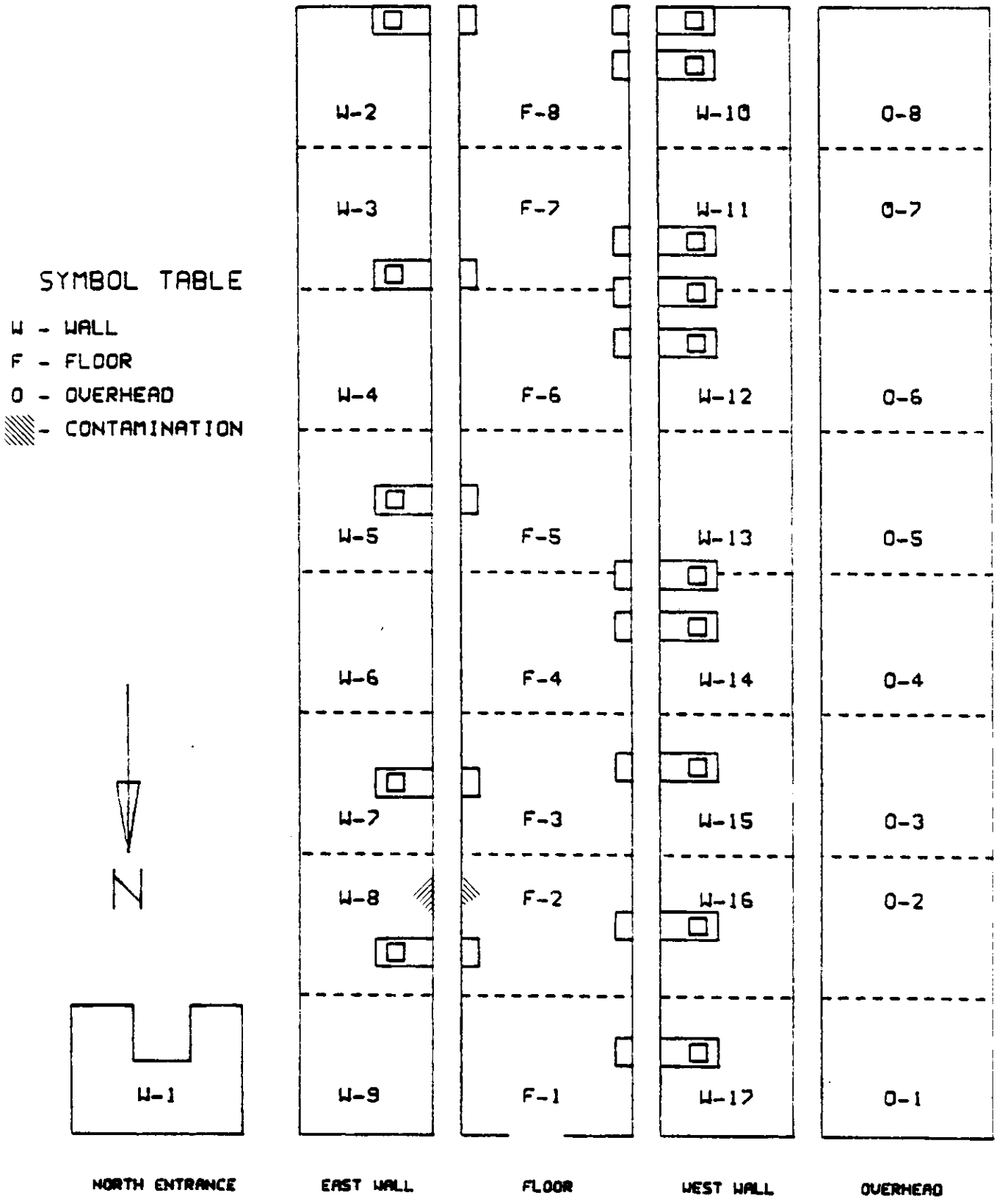
115 D/DR COOLER BLOWER ROOM #2

UNI-3807



(NOT TO SCALE)

115 D/DR OPERATING GALLERY



(NOT TO SCALE)

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APPENDIX B

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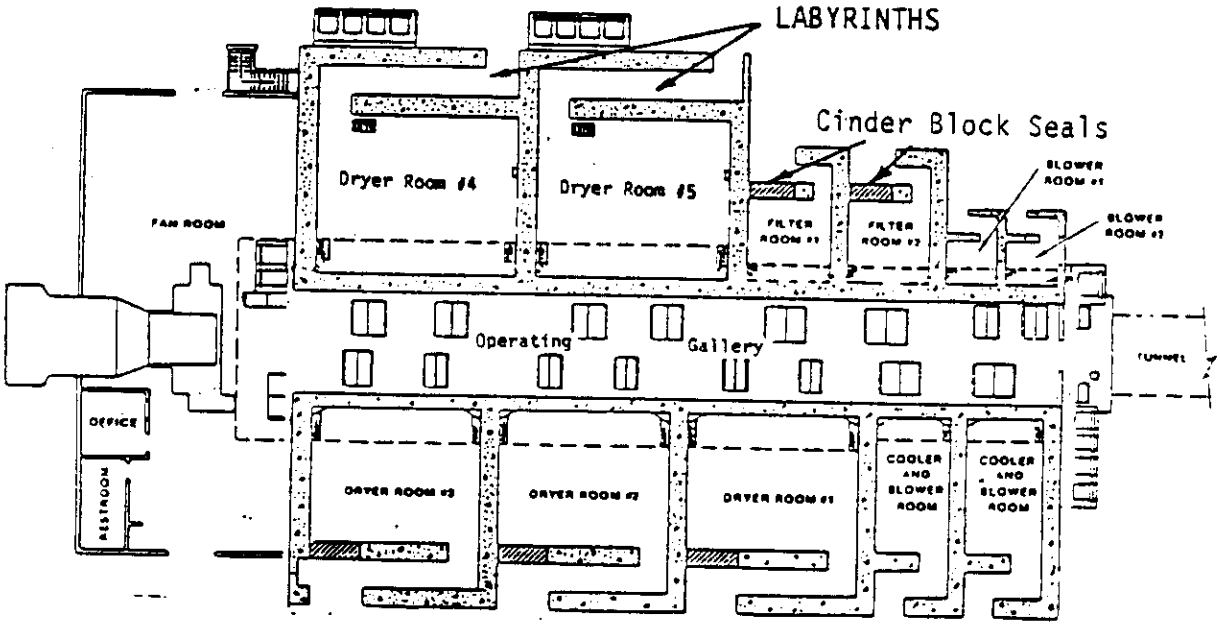
Appendix B is arranged by room area within the 115-D/DR Gas Recirculation Building. The areas of the superstructure were surveyed and sampled to characterize the building for disposal as clean waste. The following section contains grid diagrams for each room, the tabulated results of concrete samples counted for dispersed activity, and the final large-area probe surveys for unconditional release.

Each cell, room, or area is depicted as a separate drawing for clarity. There are drawings to show the approximate locations where concrete samples were taken. These drawings use the technique of unfolding the walls and overhead to lie in the same plane with the floor.

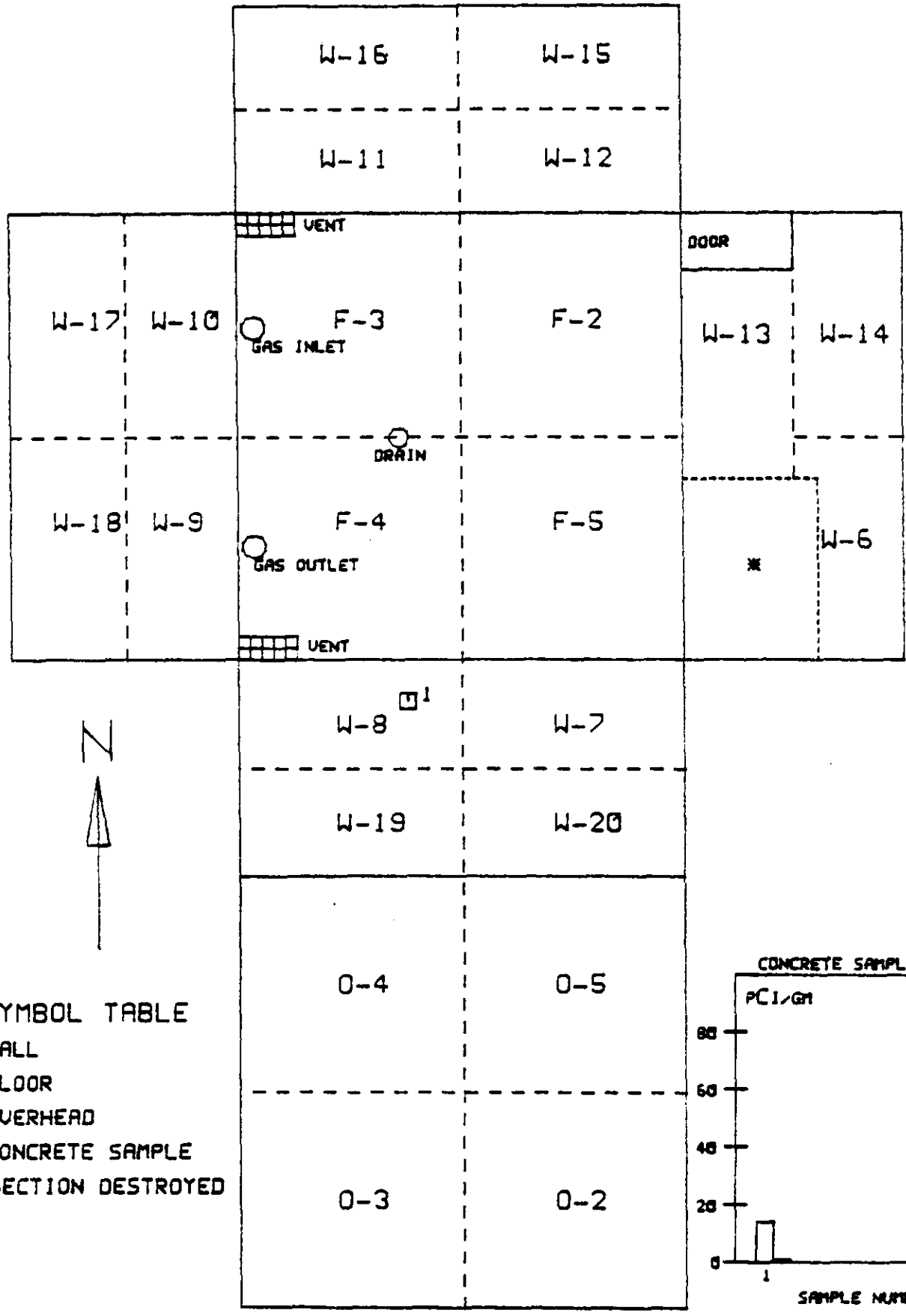
Room openings are either labeled or marked as indicated in the symbol table on the individual sheets. Each grid area is indicated with a dashed line at one or more of its boundaries. Openings in the walls that were made by removal of bricks and mortar are indicated by a fine dashed line. Portions of the walls that were demolished to allow equipment removal are shown with a wave-like line. The general layout of the building is shown below for reference.



Overall Plan of 115-D/DR Layout

UNI-3807

115 D/DR DRIER ROOM #1



SYMBOL TABLE

W = WALL
F = FLOOR
O = OVERHEAD
□ = CONCRETE SAMPLE
※ = SECTION DESTROYED

(NOT TO SCALE)

Radiation Survey Data- DRYER ROOM no. 1 - 1150/DR Gas Recirculation Bldg.

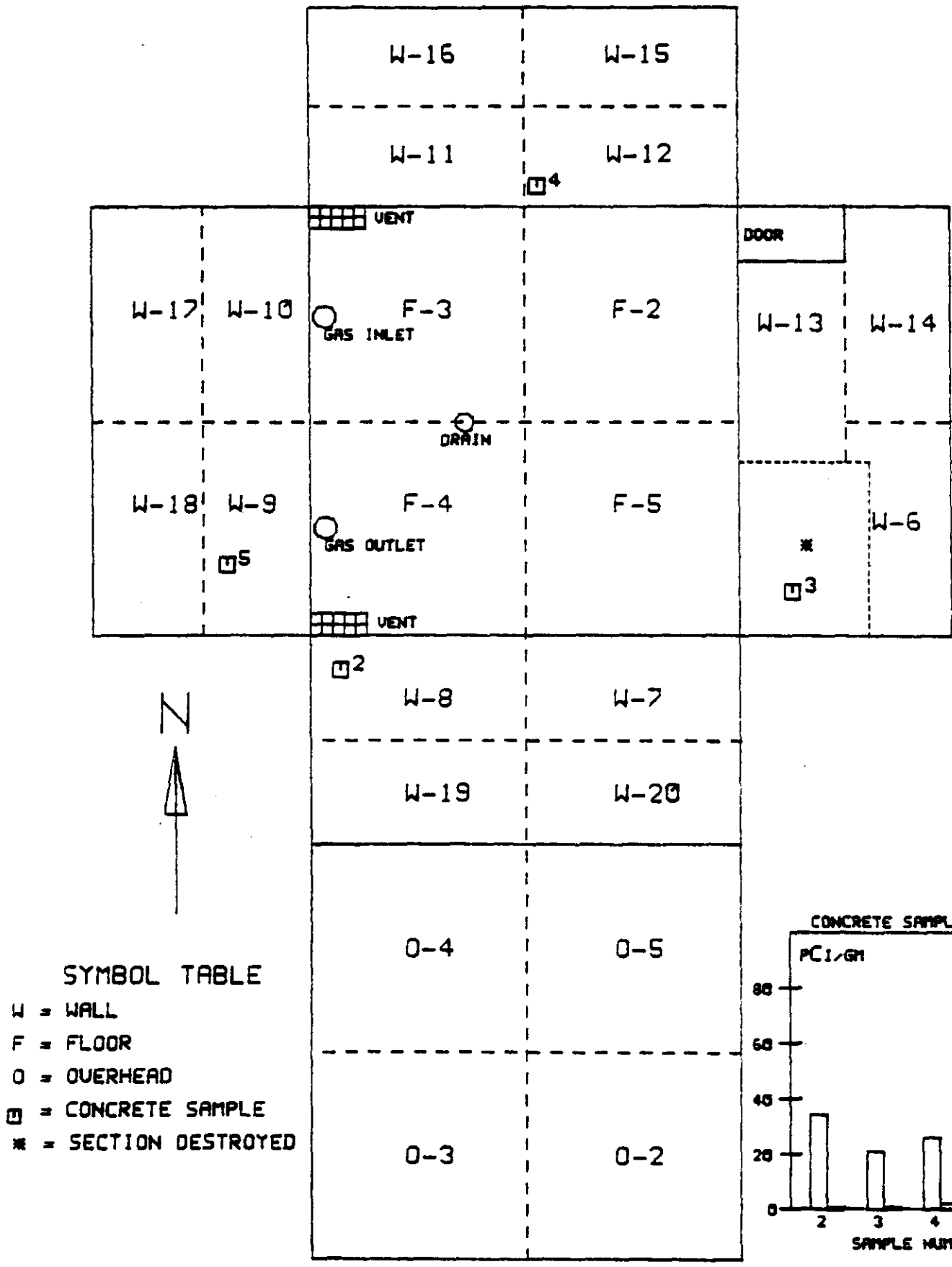
LAPDDR01

LARGE AREA PROBE SURVEY RESULTS

SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	uR/hr	SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	uR/hr
D-2	<125	<8	10-12	W-15	<125	<8	10-12
D-3	<125	<8	10-12	W-16	<125	<8	10-12
D-4	<125	<8	10-12	W-17	<125	<8	10-12
D-5	<125	<8	10-12	W-18	<125	<8	10-12
W-5	<125	<8	10-12	W-19	<125	<8	10-12
W-6	<125	<8	10-12	W-20	<125	<8	10-12
W-7	<125	<8	10-12				
W-8	125	8	10-12	LABYRINTH			
W-9	250	8	10-12				
W-10	250	<8	10-12	D-1	<125	<8	10-12
W-11	<125	<8	10-12	W-1	<125	<8	10-12
W-12	<125	<8	10-12	W-2	<125	<8	10-12
W-13	125	<8	10-12	W-3	125	<8	10-12
W-14	<125	<8	10-12	W-4	<125	<8	10-12

INSTRUMENTATION:
  Alpha: MS-2 #41333
  Beta: LUDLUM #15187
  Gamma: LUDLUM #501B
BACKGROUND:
  Outside Bldg. = 12-14 uR/hr.

115 D/DR DRIER ROOM #2



SYMBOL TABLE

W = WALL
F = FLOOR
O = OVERHEAD
□ = CONCRETE SAMPLE
※ = SECTION DESTROYED

(NOT TO SCALE)

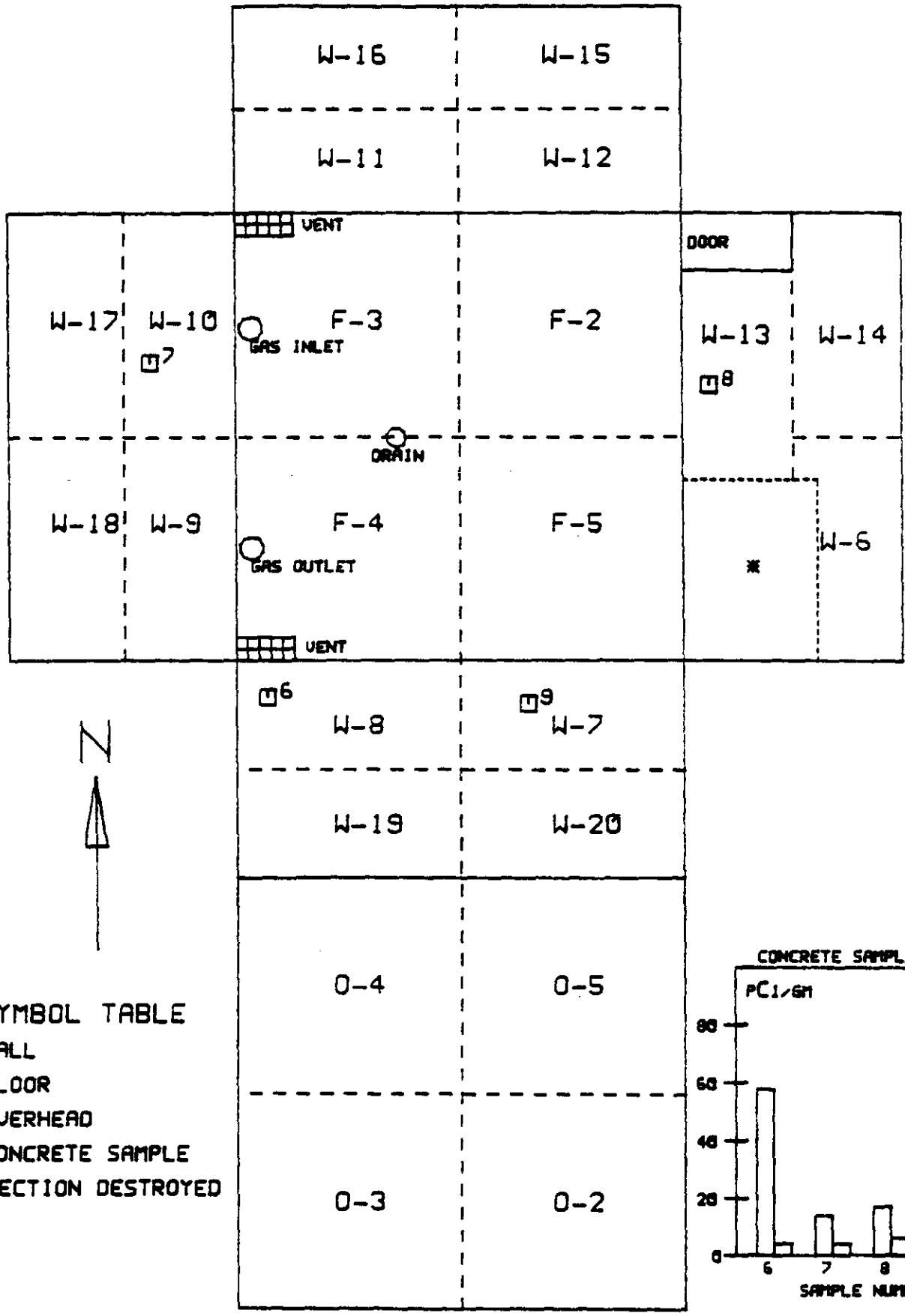
LAPDDR02
#2

LARGE AREA PROBE SURVEY RESULTS

SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	uR/hr	SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	uR/hr
D-2	<125	<8	10-12	W-15	<125	<8	10-12
D-3	<125	<8	10-12	W-16	<125	<8	10-12
D-4	<125	<8	10-12	W-17	<125	<8	10-12
D-5	<125	<8	10-12	W-18	<125	<8	10-12
W-5	<125	<8	10-12	W-19	<125	<8	10-12
W-6	<125	<8	10-12	W-20	<125	<8	10-12
W-7	<125	<8	10-12				
W-8	500	<8	10-12	LABYRINTH			
W-9	500	<8	10-12				
W-10	375	<8	10-12	D-1	<125	<8	10-12
W-11	<125	<8	10-12	W-1	<125	<8	10-12
W-12	<125	<8	10-12	W-2	<125	<8	10-12
W-13	<125	<8	10-12	W-3	<125	<8	10-12
W-14	<125	<8	10-12	W-4	<125	<8	10-12

INSTRUMENTATION:
Alpha: MS-2 #41388
Beta: LUDLUM 15157
Gamma: LUDLUM #5016
BACKGROUND:
Outside Bldg. = 12-14 uR/hr.

115 D/DR DRIER ROOM #3



SYMBOL TABLE

W = WALL
F = FLOOR
O = OVERHEAD
□ = CONCRETE SAMPLE
※ = SECTION DESTROYED

(NOT TO SCALE)

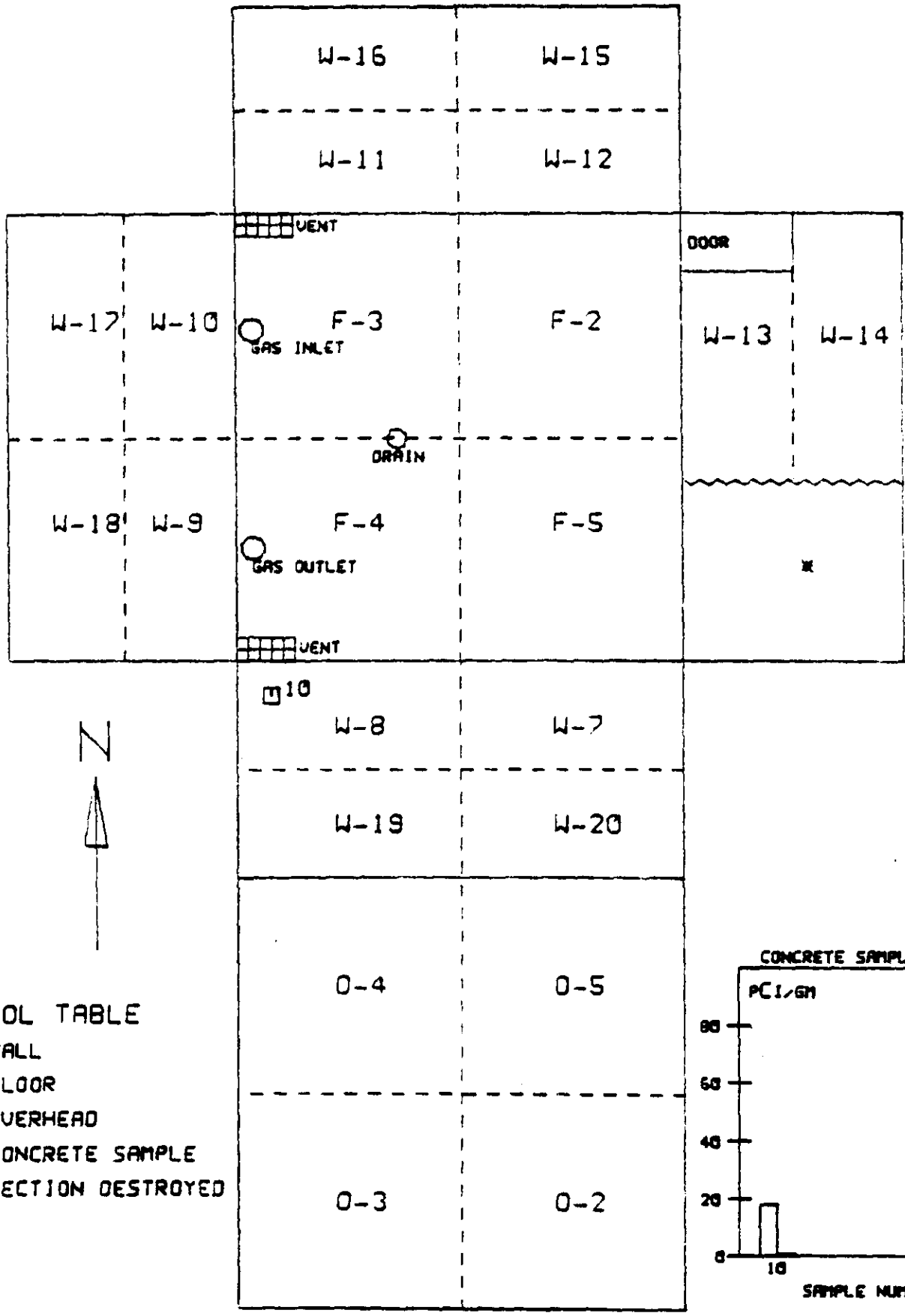
LAPDDRD3
#3

LARGE AREA PROBE SURVEY RESULTS

SURVEY GRID	DIRECT READINGS Beta dpm/100 cm2	Alpha dpm/100 cm2	uR/hr	SURVEY GRID	DIRECT READINGS Beta dpm/100 cm2	Alpha dpm/100 cm2	uR/hr
D-2	<125	<8	10-12	W-15	<125	<8	10-12
D-3	<125	<8	10-12	W-16	<125	<8	10-12
D-4	<125	<8	10-12	W-17	<125	<8	10-12
D-5	<125	<8	10-12	W-18	<125	<8	10-12
W-5	<125	<8	10-12	W-19	<125	<8	10-12
W-6	<125	<8	10-12	W-20	<125	<8	10-12
W-7	<125	<8	10-12				
W-8	<125	<8	10-12	LABYRINTH			
W-9	<125	<8	10-12				
W-10	<125	<8	10-12	D-1	<125	<8	10-12
W-11	<125	<8	10-12	W-1	<125	<8	10-12
W-12	<125	<8	10-12	W-2	<125	<8	10-12
W-13	<125	<8	10-12	W-3	<125	<8	10-12
W-14	<125	<8	10-12	W-4	<125	<8	10-12

INSTRUMENTATION:
Alpha: MS-2 #41038
Beta: LUDLUM #15187
Gamma: LUDLUM #5016
BACKGROUND:
Outside Bldg. = 12-14 uR/hr.

115 D/DR DRIER ROOM #4



SYMBOL TABLE

W = WALL
F = FLOOR
O = OVERHEAD
□ = CONCRETE SAMPLE
* = SECTION DESTROYED

(NOT TO SCALE)

LAP00R04
#4

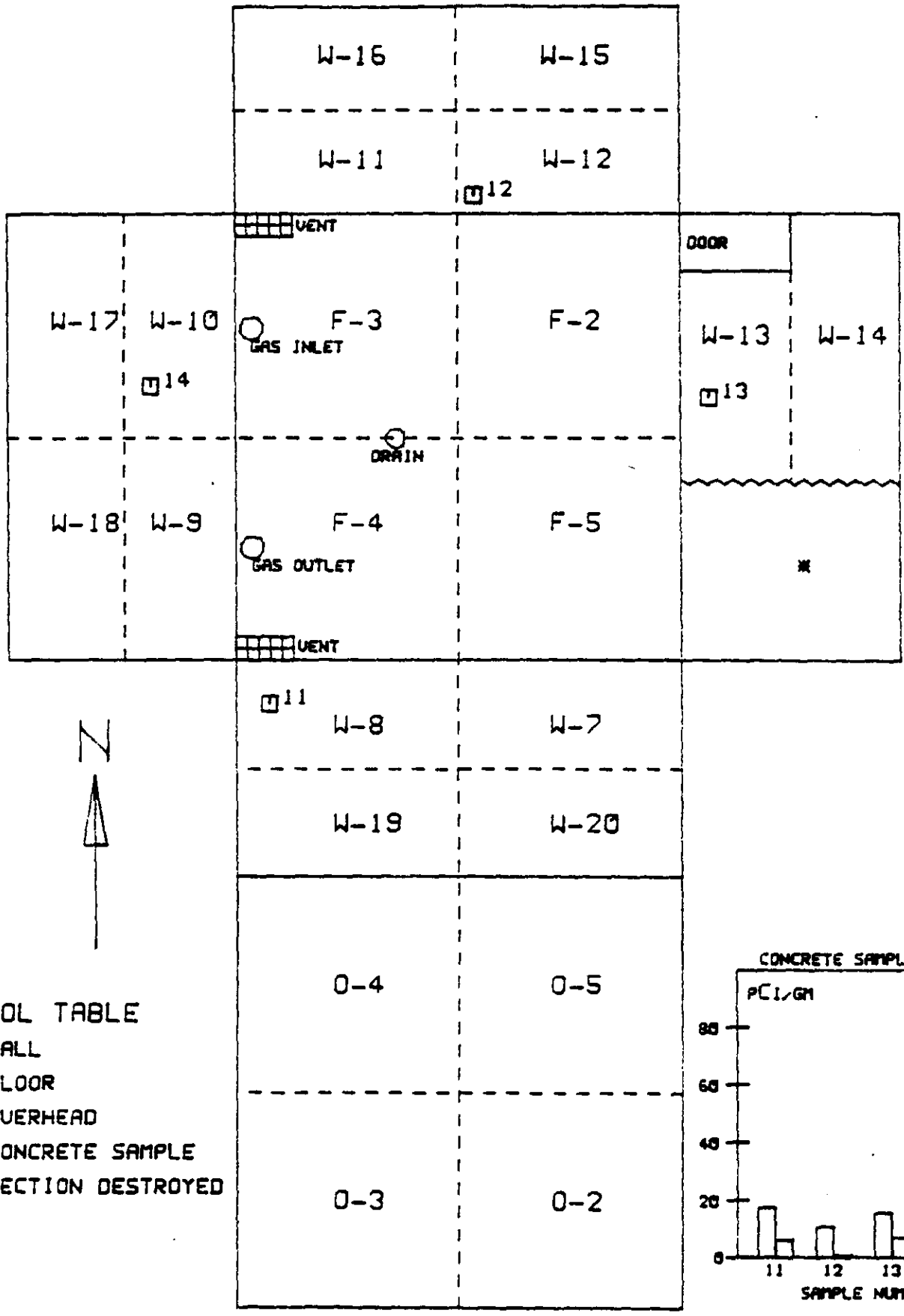
LARGE AREA PROBE SURVEY RESULTS

SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	uR/hr	SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	uR/hr
D-2	<125	<8	10-12	W-15	<125	<8	10-12
D-3	<125	<8	10-12	W-16	<125	<8	10-12
D-4	<125	<8	10-12	W-17	<125	<8	10-12
D-5	<125	<8	10-12	W-18	<125	<8	10-12
W-5	<125	<8	10-12	W-19	<125	<8	10-12
W-6	<125	<8	10-12	W-20	<125	<8	10-12
W-7	<125	<8	10-12				
W-8	<125	<8	10-12	LABYRINTH			
W-9	<125	<8	10-12				
W-10	<125	<8	10-12	D-1	<125	<8	10-12
W-11	<125	<8	10-12	W-1	<125	<8	10-12
W-12	<125	<8	10-12	W-2	<125	<8	10-12
W-13	<125	<8	10-12	W-3	<125	<8	10-12
W-14	<125	<8	10-12	W-4	<125	<8	10-12

INSTRUMENTATION:
Alpha: MS-2 #41388
Beta: LUDLUM #15187
Gamma: LUDLUM #5016
BACKGROUND:
Outside Bldg. = 12-14 uR/hr.

UNI-3807

115 D/DR DRIER ROOM #5



SYMBOL TABLE

W = WALL
F = FLOOR
O = OVERHEAD
□ = CONCRETE SAMPLE
* = SECTION DESTROYED

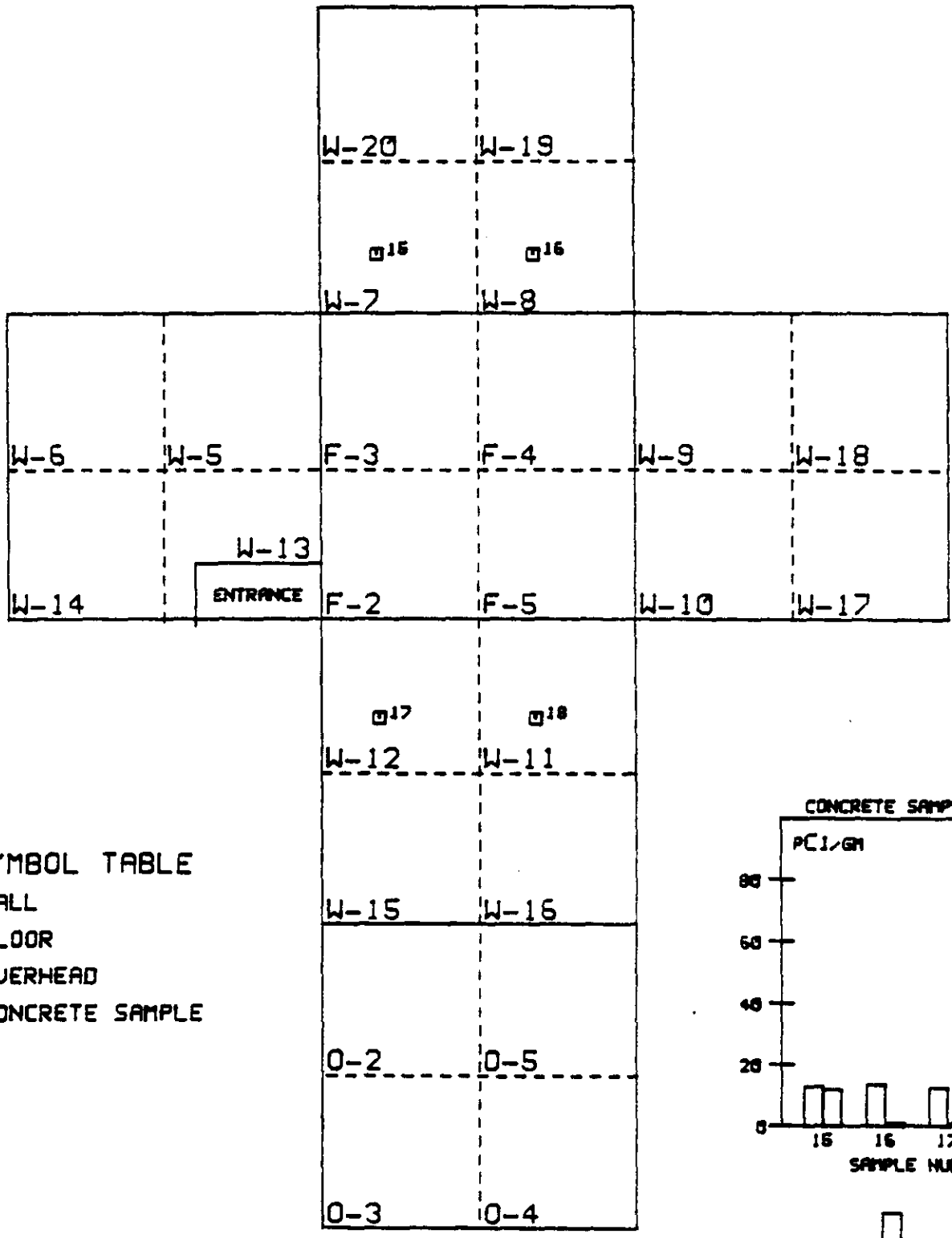
(NOT TO SCALE)

LARGE AREA PROBE SURVEY RESULTS

SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	GAMMA uR/hr	SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	GAMMA uR/hr
D-2	<125	<8	10-12	W-15	<125	<8	10-12
D-3	<125	<8	10-12	W-16	<125	<8	10-12
D-4	<125	<8	10-12	W-17	<125	<8	10-12
D-5	<125	<8	10-12	W-18	<125	<8	10-12
W-5	<125	<8	10-12	W-19	<125	<8	10-12
W-6	<125	<8	10-12	W-20	<125	<8	10-12
W-7	<125	<8	10-12				
W-8	<125	<8	10-12	LABYRINTH			
W-9	<125	<8	10-12				
W-10	<125	<8	10-12	D-1	<125	<8	10-12
W-11	<125	<8	10-12	W-1	<125	<8	10-12
W-12	<125	<8	10-12	W-2	<125	<8	10-12
W-13	<125	<8	10-12	W-3	<125	<8	10-12
W-14	<125	<8	10-12	W-4	<125	<8	10-12

INSTRUMENTATION:
Alpha: MS-2 #41388
Beta: LUDLUM #15187
Gamma: LUDLUM #5016
BACKGROUND:
Outside building = 10-14 uR/hr.

115 D/DR COOLER BLOWER ROOM #1



SYMBOL TABLE

W = WALL

F = FLOOR

O = OVERHEAD

⊙ = CONCRETE SAMPLE

(NOT TO SCALE)

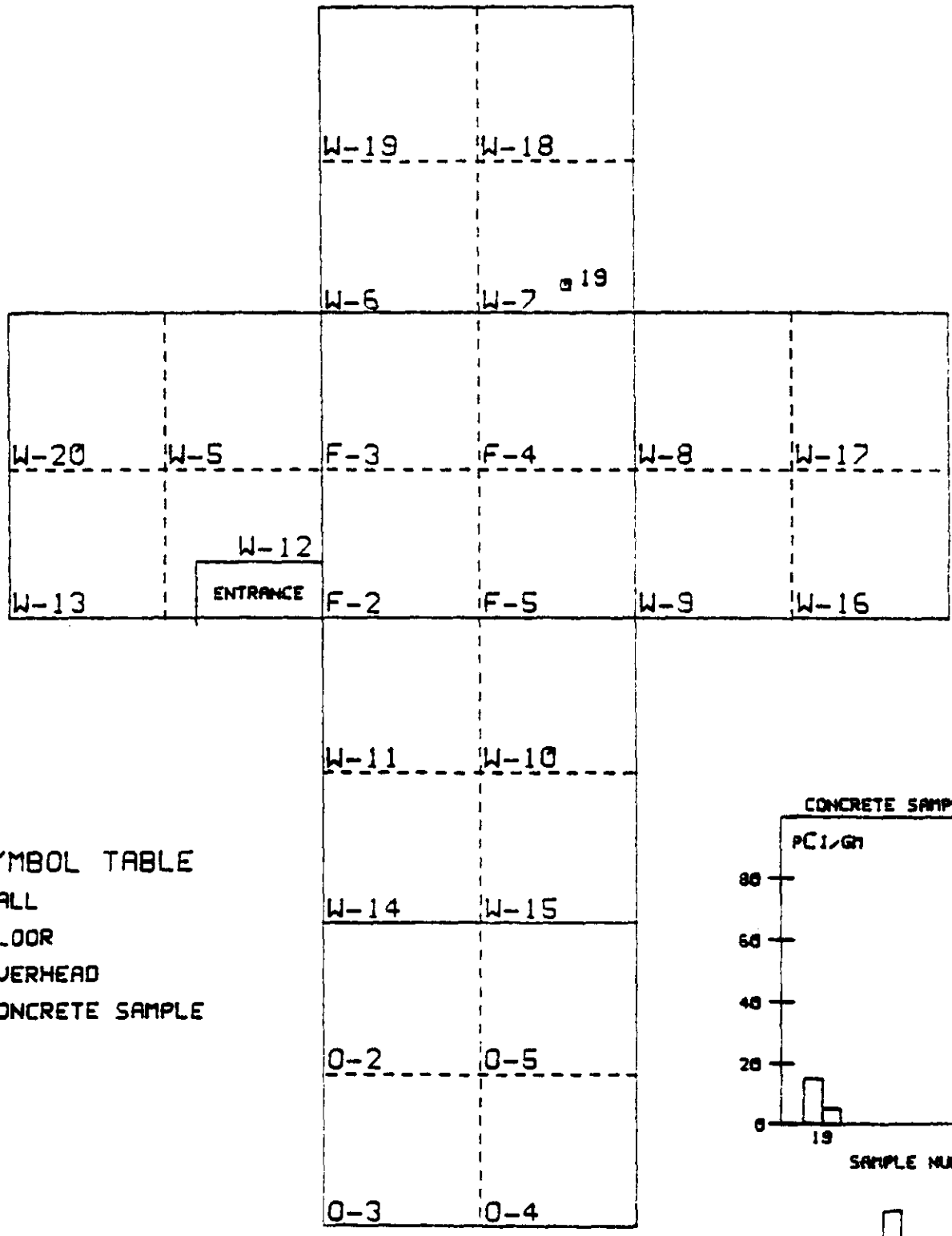
LAPDDR
CS#1

LARGE AREA PROBE SURVEY RESULTS

SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	Gamma uR/hr	SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	Gamma uR/hr
D-2	<125	<8	10-12	W-15	<125	<8	10-12
D-3	<125	<8	10-12	W-16	<125	<8	10-12
D-4	<125	<8	10-12	W-17	<125	<8	10-12
D-5	<125	<8	10-12	W-18	<125	<8	10-12
W-7	<125	<8	10-12	W-19	<125	<8	10-12
W-8	<125	<8	10-12	W-20	<125	<8	10-12
W-9	<125	<8	10-12				
W-10	<125	<8	10-12				
W-11	<125	<8	10-12	LABYRINTH			
W-12	<125	<8	10-12				
W-13	<125	<8	10-12	W-1	<125	<8	10-12
W-14	<125	<8	10-12	W-5	<125	<8	10-12

INSTRUMENTATION:
Alpha: HS-2 #41388
Beta: LUDLUM #15187
Gamma: LUDLUM #5016
BACKGROUND:
Outside Building = 12-14 uR/hr.

115 D/DR COOLER BLOWER ROOM #2



SYMBOL TABLE

W = WALL
F = FLOOR
O = OVERHEAD
□ = CONCRETE SAMPLE

(NOT TO SCALE)

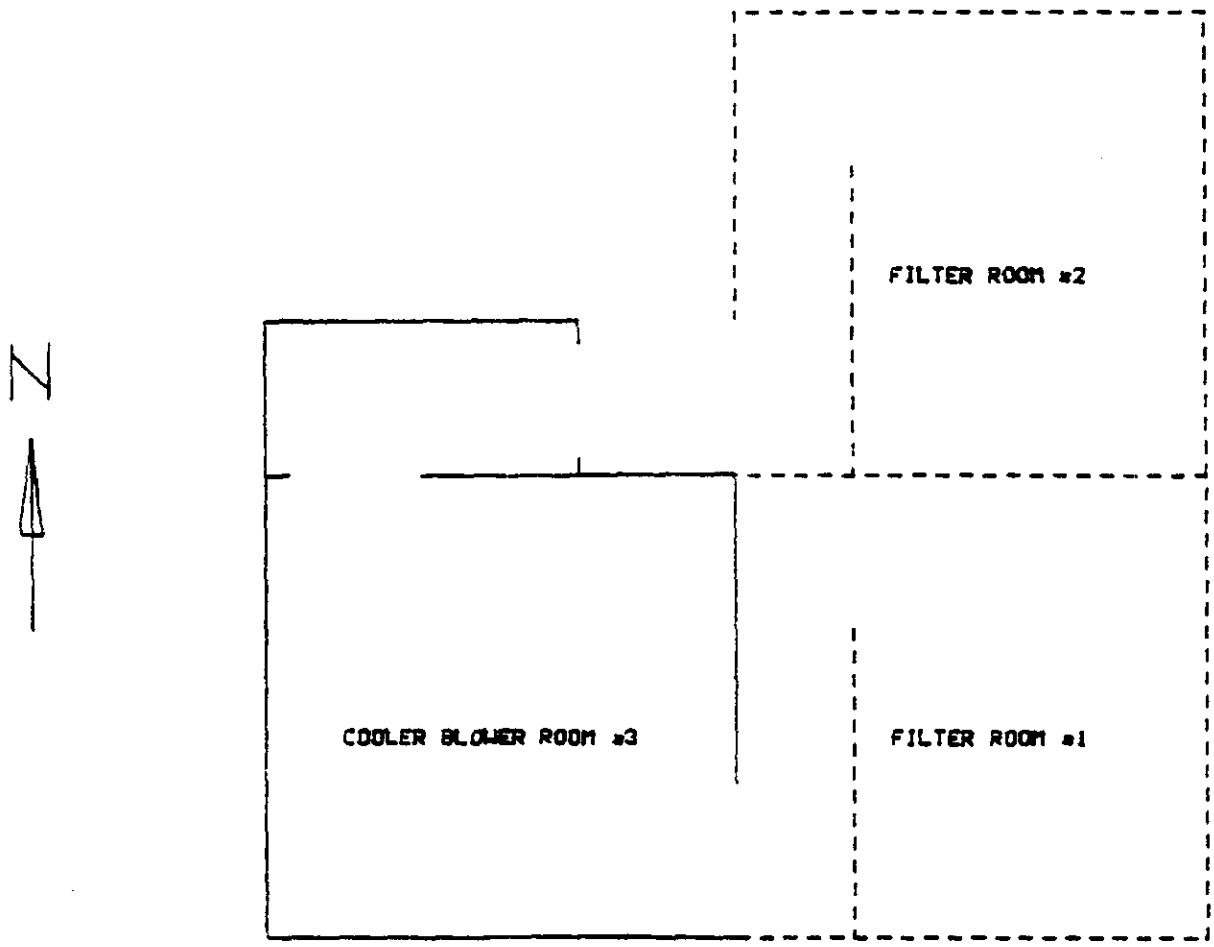
"LAPDDRCB
CB#2

LARGE AREA PROBE SURVEY RESULTS

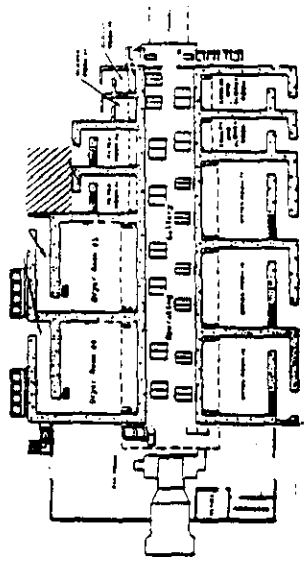
SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	uR/hr	SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	uR/hr
O-2	<125	<8	10-12	W-15	<125	<8	10-12
O-3	<125	<8	10-12	W-16	<125	<8	10-12
O-4	<125	<8	10-12	W-17	<125	<8	10-12
O-5	<125	<8	10-12	W-18	<125	<8	10-12
W-5	<125	<8	10-12	W-19	<125	<8	10-12
W-6	<125	<8	10-12	W-20	<125	<8	10-12
W-7	<125	<8	10-12				
W-8	<125	<8	10-12	LABYRINTH			
W-9	<125	<8	10-12				
W-10	<125	<8	10-12	O-1	<125	<8	10-12
W-11	<125	<8	10-12	W-1	<125	<8	10-12
W-12	<125	<8	10-12	W-2	<125	<8	10-12
W-13	<125	<8	10-12	W-3	<125	<8	10-12
W-14	<125	<8	10-12	W-4	<125	<8	10-12

INSTRUMENTATION:
Alpha: MS-2 #41388
Beta: LUDLUM #15187
Gamma: LUDLUM #5016
BACKGROUND:
Outside Bldg. = 12-14 uR/hr.

115 D/DR COOLER BLOWER ROOM #3 FLOOR PLAN



= LOCATION OF COOLER BLOWER ROOM #3 ON OVERALL FACILITY LAYOUT. DIAGRAM NOT TO SCALE.



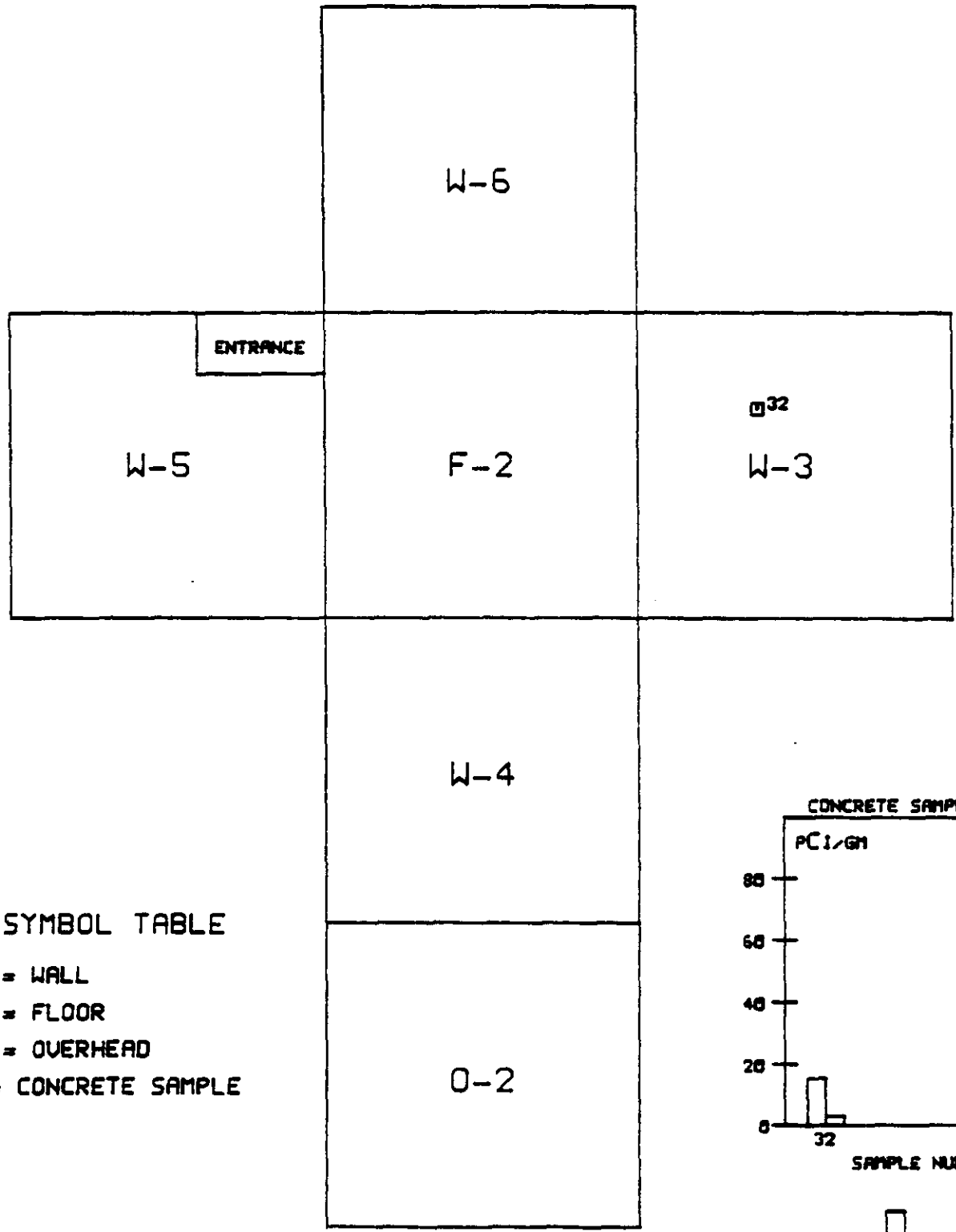
OVERALL PLAN OF 115 D/DR LAYOUT

CBROOMC GROUP II DDRFR1

SAMPLE LOCATION Room no.3	DIRECT READINGS B-G cpm	ALPHA dpm	SAMPLE I.D. NUMBER	TECHNICAL SMEARS B-G dpm/100 cm2	ALPHA dpm/100 cm2	MASSLINN SMEARS Beta dpm/m2	Alpha dpm/m2	MICRO R/hr Gamma Field
F-1	<200	ND	BF-49	4	ND	<200	ND	10-12
F-2	<200	ND	BF-50	<MDA	ND	<200	ND	10-12
W-1	<200	ND	BW-38	<MDA	ND	<200	ND	10-12
W-2	<200	ND	BW-39	<MDA	ND	<200	ND	10-12
W-3	<200	ND	BW-40	<MDA	ND	<200	ND	10-12
W-4	<200	ND	BW-41	<MDA	ND	<200	ND	10-12
W-5	<200	ND	BW-42	<MDA	ND	<200	ND	10-12
W-6	<200	ND	BW-43	12	3	<200	ND	10-12
W-7	<200	ND	BW-44	<MDA	ND	<200	ND	10-12
W-8	<200	ND	BW-45	<MDA	ND	<200	ND	10-12
W-9	<200	ND	BW-46	9	ND	<200	ND	10-12
W-10	<200	ND	BW-47	<MDA	ND	<200	ND	10-12
W-11	<200	ND	BW-48	<MDA	ND	<200	ND	10-12
D-1	<200	ND	BD-51	<MDA	ND	<200	ND	10-12
D-2	<200	ND	BD-52	<MDA	ND	<200	ND	10-12

COMMENTS: BACKGROUND: Outside Building = 12-14 uR/hr.
ND = None detected

115 D/DR PURGE BLOWER ROOM "1

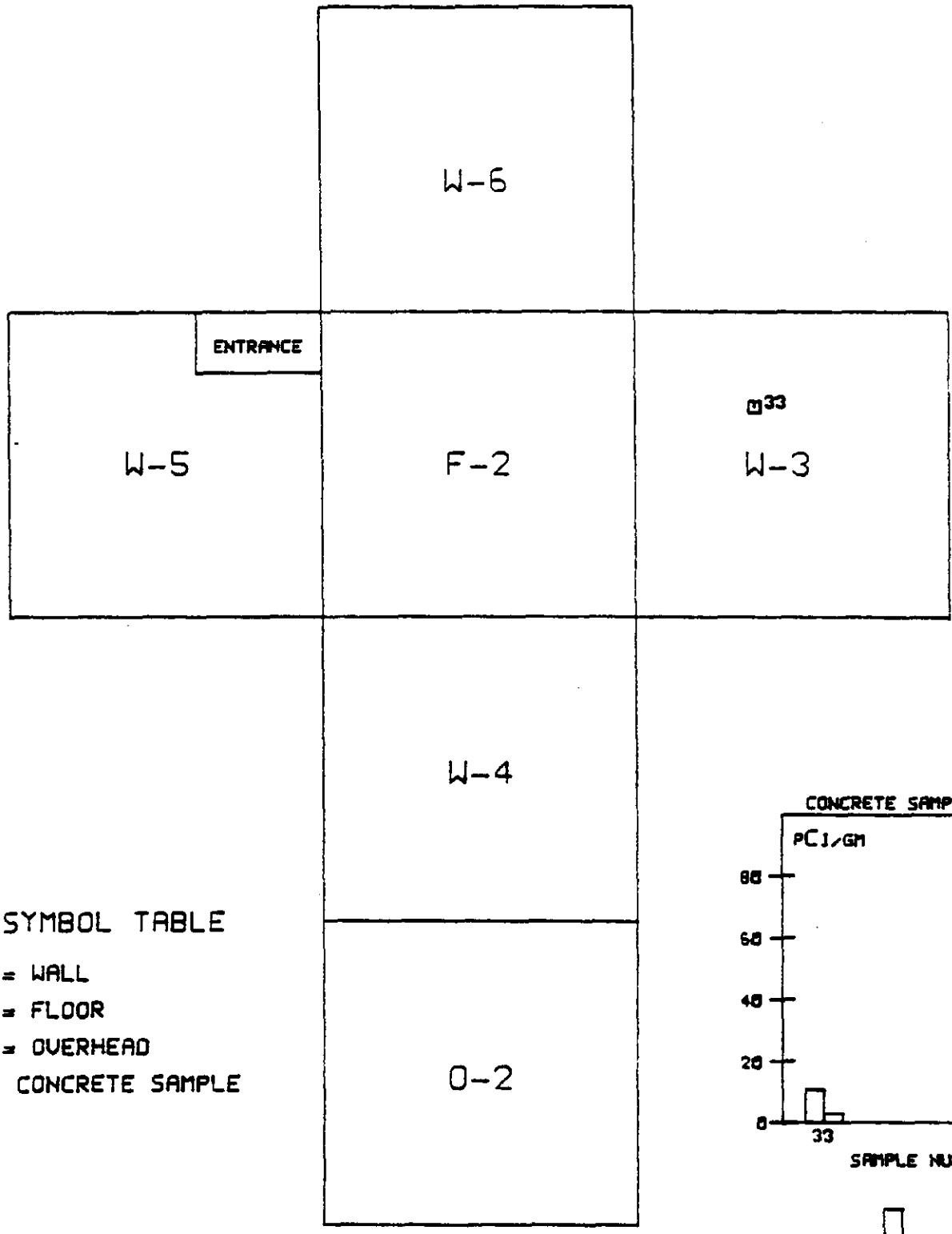


SYMBOL TABLE

W = WALL
F = FLOOR
O = OVERHEAD
⊡ = CONCRETE SAMPLE

(NOT TO SCALE)

115 D/DR PURGE BLOWER ROOM #2



SYMBOL TABLE

W = WALL
F = FLOOR
O = OVERHEAD
⊡ = CONCRETE SAMPLE

(NOT TO SCALE)

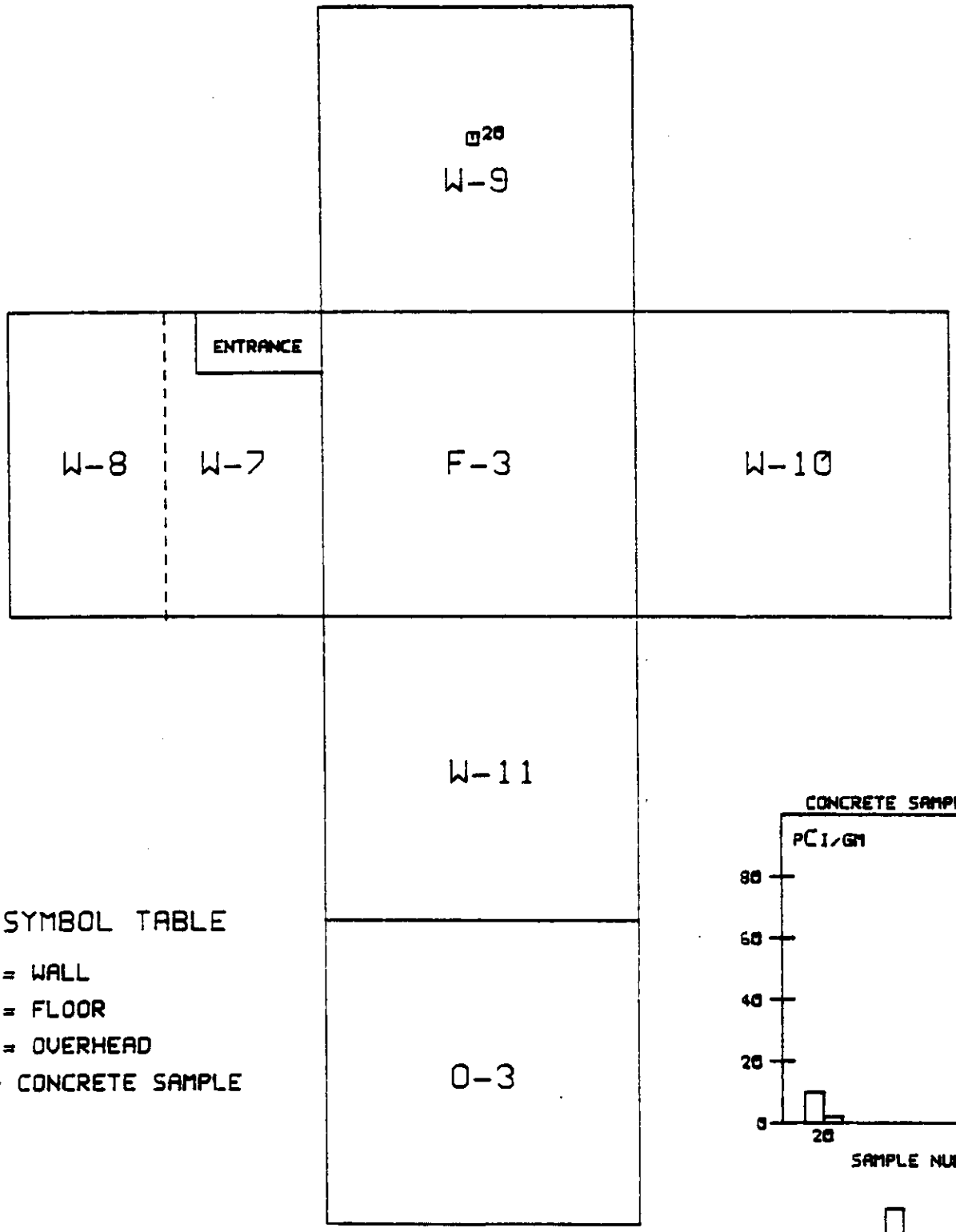
LAPDDRPB
PB-1 & 2

LARGE AREA PROBE SURVEY RESULTS

SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	Gamma uR/HR
PURGE BLOWER NO.1			
D-2	<125	<8	10-12
W-2	<125	<8	10-12
W-3	<125	<8	10-12
W-4	<125	<8	10-12
W-5	<125	<8	10-12
W-6	<125	<8	10-12
PURGE BLOWER NO.2			
D-2	<125	<8	10-12
W-2	<125	<8	10-12
W-3	<125	<8	10-12
W-4	<125	<8	10-12
W-5	<125	<8	10-12
W-6	<125	<8	10-12

INSTRUMENTATION:
Alpha: MS-2 #41788
Beta: Ludlum #15187
BACKGROUND:
Outside Building = 12-14 Ur/HR.

115 D/DR FILTER ROOM #1

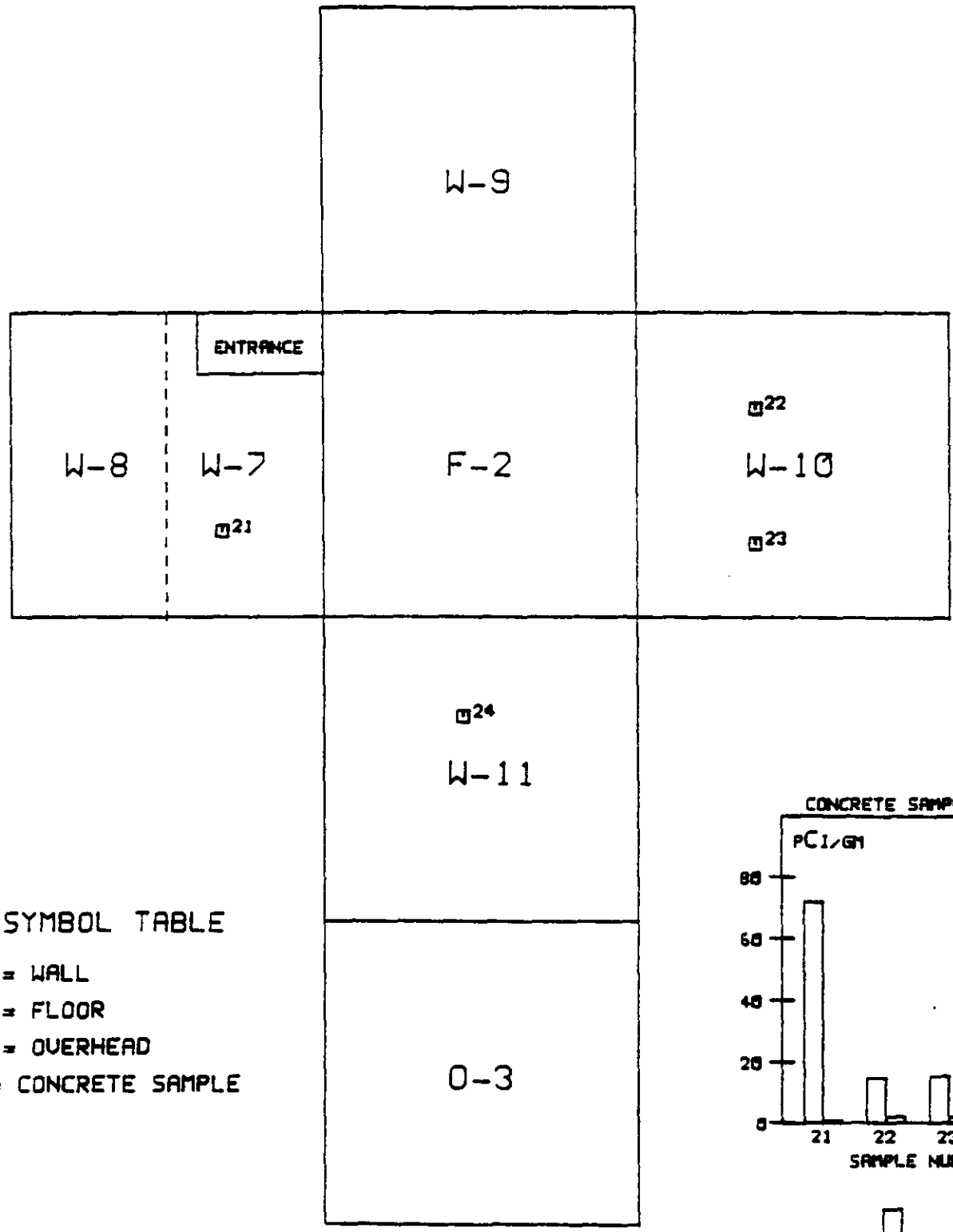


SYMBOL TABLE

W = WALL
F = FLOOR
O = OVERHEAD
▣ = CONCRETE SAMPLE

(NOT TO SCALE)

115 D/DR FILTER ROOM #2



SYMBOL TABLE

W = WALL
F = FLOOR
O = OVERHEAD
▣ = CONCRETE SAMPLE

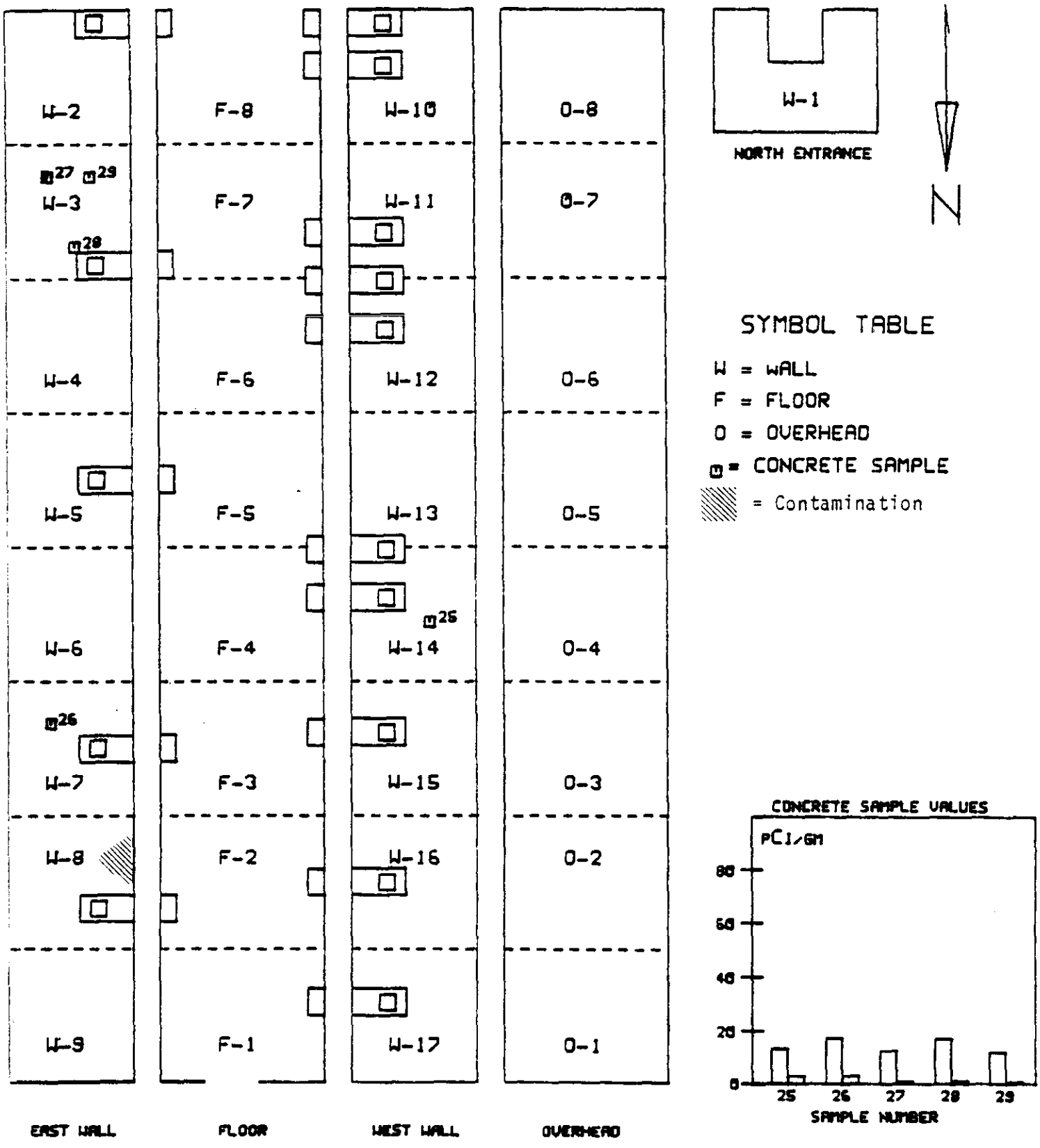
(NOT TO SCALE)

LARGE AREA PROBE SURVEY RESULTS

SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	Gamma uR/hr	SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	Gamma uR/hr
FILTER ROOM NO.1				FILTER ROOM NO. 2			
A-9	<100	<8	10-12	A-7	<100	<8	10-12
A-10	<100	8	10-12	A-8	<100	<8	10-12
A-11	100	<8	10-12	A-9	<100	8	10-12
B-9	100	8	10-12	B-8	100	8	10-12

INSTRUMENTATION:
Alpha: MS-2 #41038
Beta: LUDLUM #15197
Gamma: LUDLUM #2241
BACKGROUND:
Outside Building = 10-14 uR/hr.

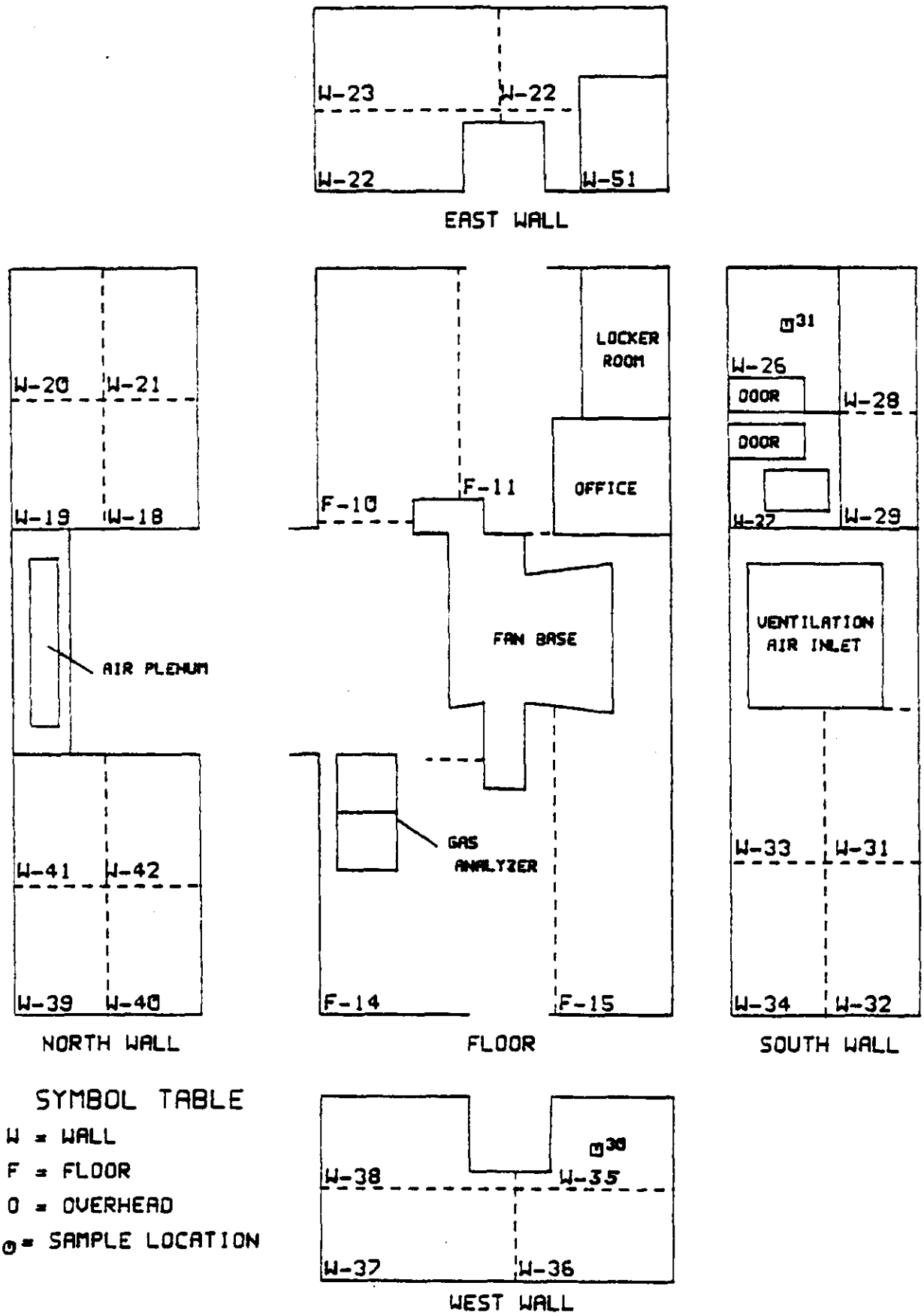
115 D/DR OPERATING GALLERY



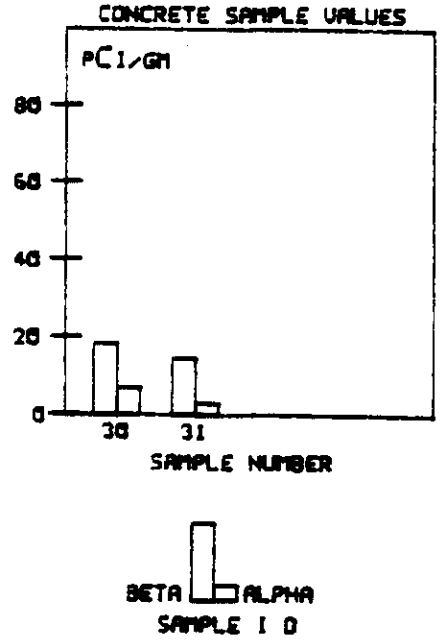
SYMBOL TABLE

W = WALL
F = FLOOR
O = OVERHEAD
= CONCRETE SAMPLE
= Contamination

115 D/DR FAN ROOM



115 D/DR FAN ROOM



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LARGE AREA PROBE SURVEY RESULTS

	DIRECT READINGS				DIRECT READINGS			
	SURVEY GRID	Beta DPM/100 cm2	Alpha DPM/100cm2	Gamma uR/hr	SURVEY GRID	Beta DPM/100 cm2	Alpha DPM/100 cm2	Gamma uR/hr	
Op. Gallery	O-1	125	<8	9-11	W-22	<125	<8	9-11	Fan Room
	O-2	<125	<8	9-11	W-23	125	<8	9-11	
	O-3	125	<8	9-11	W-24	<125	<8	9-11	
	O-4	125	<8	9-11	W-25	125	<8	9-11	
	O-5	<125	<8	9-11	W-26	<125	<8	9-11	
	O-6	<125	<8	9-11	W-27	<125	<8	9-11	
	O-7	<125	<8	9-11	W-28	125	<8	9-11	
	O-8	<125	<8	9-11	W-29	250	<8	9-11	
	W-1	<125	<8	9-11	W-30	<125	<8	9-11	
	W-2	<125	<8	9-11	W-31	<125	<8	9-11	
	W-3	<125	<8	9-11	W-32	125	<8	9-11	
	W-4	<125	<8	9-11	W-33	<125	<8	9-11	
	W-5	<125	<8	9-11	W-34	<125	<8	9-11	
	W-6	<125	<8	9-11	W-35	125	<8	9-11	
	W-7	<125	<8	9-11	W-36	125	<8	9-11	
	W-8 *	<125	<8	9-11	W-37	125	<8	9-11	
	W-9	<125	<8	9-11	W-38	<125	<8	9-11	
	W-10	<125	<8	9-11	W-39	<125	<8	9-11	
	W-11	<125	<8	9-11	W-40	125	<8	9-11	
	W-12	<125	<8	9-11	W-41	<125	<8	9-11	
	W-13	<125	<8	9-11	W-42	125	<8	9-11	Fan Room
	W-14	<125	<8	9-11	W-43	<125	<8	9-11	Locker Room
	W-15	<125	<8	9-11	W-44	125	<8	9-11	
	W-16	<125	<8	9-11	W-45	<125	<8	9-11	
Op. Gallery	W-17	<125	<8	9-11	W-46	<125	<8	9-11	Locker Room
Fan Room	W-18	<125	<8	9-11	W-47	<125	<8	9-11	Office
	W-19	<125	<8	9-11	W-48	125	<8	9-11	
	W-20	<125	<8	9-11	W-49	<125	<8	9-11	
Fan Room	W-21	<125	<8	9-11	W-50	<125	<8	9-11	Office

INSTRUMENTATION:
Alpha: MS-2 #41388
Beta: LUDLUM #15187
Gamma LUDLUM #5016
BACKGROUND:
Outside Building = 12-14 uR/hr.

* After clean concrete put in place to cover residual contamination.

Radiation Survey Data- INSTRUMENT CUBICLES - 115D/DR Gas Recirculation Bldg.

LAPDORIC
INSTRUMENT CUBICLES

LARGE AREA PROBE SURVEY RESULTS

	SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	Gamma uR/hr	SURVEY GRID	DIRECT READINGS Beta DPM/100 cm2	Alpha DPM/100 cm2	Gamma uR/hr
Outside bldg	IC-1	<125	<8	12-14	IC-8	<125	<8	12-14
	IC-2	<125	<8	12-14	IC-9	<125	<8	12-14
	IC-3	<125	<8	12-14	IC-10	<125	<8	12-14
	IC-4	<125	<8	12-14	IC-11	<125	<8	12-14
	IC-5	<125	<8	12-14	IC-12	<125	<8	12-14
	IC-6	<125	<8	12-14	IC-13	<125	<8	12-14
Outside bldg	IC-7	<125	<8	12-14				

INSTRUMENTATION:
Alpha: MS-2 #41388
Beta: LUDLUM #15187
Gamma LUDLUM #5016
BACKGROUND:
Outside Building = 12-14 uR/hr.

APPENDIX C

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APPENDIX C

Appendix C contains the analysis results of the dispersed activity samples taken from the superstructure walls. Initially samples were taken randomly throughout the building. Subsequent samples were taken to better evaluate high activity results.

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APPENDIX C

DISPERSED ACTIVITY VALUES 115-D/DR SUPERSTRUCTURE

SAMPLE #	LOCATION	GRID #	ALPHA ACTIVITY (pCi/g)	BETA ACTIVITY (pCi/g)
1	Dryer Room #1	W-8	<.73	14.38
2	Dryer Room #2	W-8	<.73	34.51
3	"	W-5	<.73	21.14
4	"	W-12	2.21	26.11
5	"	W-9	3.21	43.89
6	Dryer Room #3	W-8	4.21	58.07
7	"	W-10	4.21	14.12
8	"	W-13	6.21	17.30
9	"	W-7	5.21	15.91
10	Dryer Room #4	W-8	<.73	18.13
11	Dryer Room #5	W-8	6.21	17.70
12	"	W-12	<.73	11.08
13	"	W-13	7.21	15.77
14	"	W-10	8.21	16.04
15	Cooler Blower Rm #1	W-7	12.22	13.28
16	"	W-8	1.21	13.71
17	"	W-12	<.73	12.75
18	"	W-11	6.21	8.35
19	Cooler Blower Rm #2	W-7	5.21	15.23
20	Filter Room #1	W-9	2.21	10.14
21	Filter Room #2	W-7	<.73	72.13
22	"	W-10	2.21	14.81
23	"	W-10	2.21	15.64
24	"	W-11	<.73	9.43
25	Operating Gallery	W-14	3.21	13.67
26	"	W-7	3.21	17.57
27	"	W-3T	<.73	12.75
28	"	W-3S	1.21	17.15
29	"	W-3N	<.73	12.20
30	Fan Room	W-35	7.21	18.65
31	"	W-26	3.21	14.82
32	Purge Blower Rm #1	W-3	3.21	15.65
33	Purge Blower Rm #2	W-3	3.21	10.95
A	183-KE	N/A	11.22	28.52
B	183-KE	N/A	9.21	25.79
C	183-KE	N/A	1.21	11.91
D	183-KE	N/A	6.21	18.25

APPENDIX C (Cont'd)

STATISTICAL CALCULATIONS

		Alpha (pCi/g)		Beta (pCi/g)
115-D/DR Samples	$\overline{x}$ =	3.34	$\overline{x}$ =	19.49
	Sx =	2.78	Sx =	13.74
	$UL_{.95}$ =	4.33	$UL_{.95}$ =	24.36
183-KE BKGD Samples	$\overline{x}$ =	6.96	$\overline{x}$ =	21.12
	Sx =	4.35	Sx =	7.52
	$UL_{.95}$ =	13.89	$UL_{.95}$ =	33.08

TERMINOLOGY

UL - Upper limit for the estimated mean.

$\overline{x}$ - Mean

Sx - Standard deviation.

n - Number of samples. (n = 33)

The upper limit (UL) of the estimated mean for the 115-D/DR and 183-KE background samples alpha and beta activities were calculated at the 95% confidence level.

Formula for 95%
Confidence Interval = $\overline{x} - t_{.05}\ Sx/\sqrt{n} \leq \mu \leq \overline{x} + t_{.05}\ Sx/\sqrt{n}$